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CONTENTS

BOHART, ANALYSIS OF THE ODYNERUS CONGRESSUS GROUP 145
LINSLEY AND MICHENER, HABITS OF TIPHIA SHASTENSIS 154
USINGER, REVISION OF THE TERMITAPHIDIDAE 155
HSIAO, A NEW MIRID FROM OREGON 160
HARRIS, THE DATE OF PUBLICATION OF LAPORTE'S ESSAI 161
JAMES, A NEW EMPIS OF THE SUBGENUS PACHYMERIA 163
WOODBURY, SUGDEN AND GILLETTE, PAINTED LADY MIGRATIONS 165
SCOTT, PACIFIC COAST COLLEMBOLA 177
SCULLEN, NOTES ON SYNONYMY IN THE GENUS CERCERIS—I 187
DRAKE, A NEW APTEROUS ARADID FROM AUSTRALIA 190
LINSLEY, A NEW SPECIES OF CALLIDIUM FROM REDWOOD 192
TITLE PAGE, TABLE OF CONTENTS AND INDEX FOR VOLUME XVIII.

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1942

THE PAN-PACIFIC ENTOMOLOGIST

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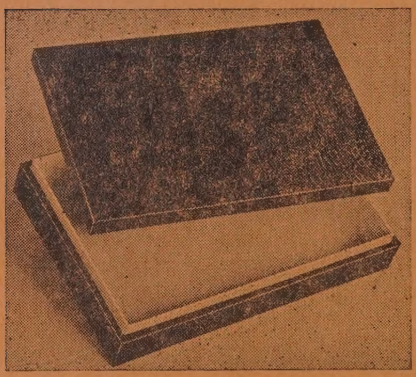

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AN ANALYSIS OF THE ODYNERUS CONGRESSUS GROUP OF THE SUBGENUS LEPTOCHILUS

(Hymenoptera, Vespidae)

BY RICHARD M. BOHART

University of California, Los Angeles

Most indications point to the origin of the subgenus *Leptochilus*[1] somewhere along the *Stenodynerus* line. If such is the case, the *congressus* group probably represents the first offshoot. This is indicated by the many characters possessed in common by the group represented by *Stenodynerus anormiformis* Vier. and the *congressus* group, which become lost or altered in the more specialized types of *Leptochilus*. These are the rounded or flattened postscutellum, the median suture of the second sternite, the shape of the second cubital cell, the five-toothed female mandibles, and the lengthened third antennal segment. In fact the chief character separating the two subgenera when these two related groups are involved is the presence in *Stenodynerus* of distinct pronotal pits.

The ocular tubercles which occur in most of the species of this group also are found in certain other *Leptochilus* as well as sparingly in other subgenera. They are typically smooth swellings tangent to the upper and inner angle of the compound eyes. Their greatest development occurs in *congressus* Vier., in which they often extend over a large portion of the face.

Specimens used in this study were borrowed from the U. S. National Museum, the Bureau of Biological Survey of the U. S. Department of Agriculture, the California Academy of Sciences, the University of Kansas, and Pomona College. I am also indebted for material to J. Bequaert, P. H. Timberlake, E. G. Linsley, C. D. Michener, M. A. Cazier, F. L. Blanc, J. H. Mitchell, L. D. Phillips, B. E. White, and N. W. Frazier.

Holotypes and allotypes have been deposited in the California Academy of Sciences.

[1] *Leptochilus* and *Stenodynerus* are here treated as subgenera of *Odynerus*. Some authors prefer to treat them as genera.

SYNOPSIS OF THE SPECIES OF THE ODYNERUS CONGRESSUS GROUP

Postscutellum not sharply crested; hind face of propodeum with a dorsolateral tubercle or short ridge; forewing with the two veinlets of the second cubital cell which border on the first and third discoidal cells forming almost a straight line; second sternite with a crease-like basal median suture; interocellar tubercles when present essentially parallel; female mandible five toothed.

1. Hind face of propodeum with a pointed tubercle on each side; front margin of pronotum with a conspicuously projecting membranous flange which is about an ocellus width; second tergite sharply reflexed apically; second sternite of male with a pair of small medio-lateral teeth 2
–. Hind face of propodeum with a short sharp dorso-lateral ridge; front margin of pronotum inconspicuous; second tergite hardly reflexed apically; male second sternite untoothed 3
2. Vertex with bulging ocellar and ocular tubercles ..... *deformiceps*
–. Vertex without ocellar or ocular tubercles ..... *platycerus*
3. Vertex without interocellar tubercles; interocellar area not furrowed; head prolonged behind the eyes; scutellum but not postscutellum pale marked; male middle femur not conspicuously deformed ..... *russipes*
–. Vertex with prominent interocellar tubercles or at least with interocellar area furrowed; scutellum and postscutellum, or the latter only, pale marked; male middle femur usually distinctly deformed 4
4. Postocular and interocellar tubercles covered with punctures except at their summits ..... *infuscipennis*
–. Tubercles very prominent, smooth and shining 5
5. First tergite (at least) marked with light reddish 6
–. First tergite marked with dark red or without red; last antennal segment of male robust and flattened; male middle femur much broader basally than trochanter 7
6. Last antennal segment of male slender and nearly cylindrical but not apically excavated; male middle femur enlarging abruptly from the base (Texas, New Mexico, and Colorado) ..... *martini*
–. Last antennal segment of male thick, flattened, and apically excavated; male middle femur enlarging abruptly from the base (California and Arizona) ..... *russatus*
7. Black with whitish markings; head swellings often enormous and extending down the face toward the ocular emarginations. ..... *congressus*
–. Black with yellow markings; head swellings moderate ..... *tetralobus*

Odynerus infuscipennis Bohart, new species

Male. Black with the following whitish yellow: Clypeus, lower eye margins, first antennal segment in front, Y-shaped interantennal spot, postocular spot, front margin of pronotum, tegula mostly, spot beneath, two spots on scutellum, stripe across post-scutellum, lateral spot on propodeum, legs partly, apices of first five tergites and second sternite, attached lateral spot on first tergite, large free lateral spot on second tergite, mandible mostly, antennal apex, legs partly, dark reddish; wing veins dark, membrane almost evenly smoky. Pubescence pale, short, and sparse. Puncturation moderately coarse, becoming coarse on second sternite, clypeus well punctured. Head about as broad as long, clypeus narrowly and roundly incised apically; third antennal segment over twice as long as broad; interocellar area furrowed but only slightly tuberculate; ocular tubercles low and punctured except at their summits. Humeral angles slightly more than 90 degrees; middle femur nearly normal. Aedeagus constricted somewhat sub-basally; paramere hairless except at inner base. Length to apex of second tergite, 6.5 mm.

Female. Clypeus black except for apical spot, complete stripe across scutellum, legs largely red and black, fifth tergite dark, venter black except for lateral spots on second sternite. Clypeus narrowly incised, apical teeth sharp; third antennal segment about twice as long as second; second abdominal segment broader than long; length of apex of second tergite, 7 mm.

Holotype male and one paratype male, Bass Lake, Madera County, California, June 6, 1938 (R. M. Bohart); allotype female and one paratype female, Mariposa, Mariposa County, California, June 13, 1938 (J. R. Warren and R. M. Bohart). One female paratype, Yakima, Washington, July 4, 1882. One male paratype, Ten Cent Lake, Steens Mts., Oregon, July 29, 1937 (Bolinger and Jewett). Ten other paratypes from the following localities (all California): Cayton, Shasta County; Meadow Valley, Plumas County; Tuolumne County, 3,500 feet; Usona, Mariposa County; Davis, Yolo County; Antioch, Contra Costa County; Murphys, Calaveras County; Cascade, Fresno County. Paratypes in collections of U. S. National Museum, J. Bequaert, and the author.

In this species the pale markings are variable. The type material is restricted to those specimens which are marked with whitish yellow, but additional specimens are at hand in which the markings are distinctly yellow as well as being more extensive. These are mainly from southern California (Monterey and Los Angeles Counties) but a few are from Davis Creek and Las-

sen Creek, Modoc County. Because of the variation even within the white-marked specimens, it does not seem worthwhile to designate these yellow forms by a separate name. Occasional white-marked females are also red-noded.

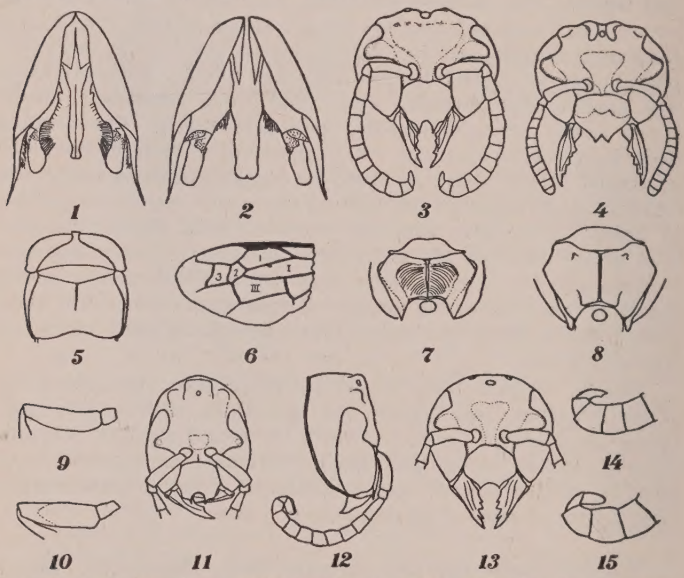

Fig. 1, *deformiceps*, dorsal view of male genitalia; fig. 2, *russatus*, dorsal view of male genitalia; fig. 3, *russatus* male, front view of head; fig. 4, *congressus* female, front view of head; fig. 5, *congressus* male, ventral view of first two abdominal segments; fig. 6, *congressus*, apical wing venation; fig. 7, *congressus*, posterior view of propodeum; fig. 8, *deformiceps*, posterior view of propodeum; fig. 9, *russatus* male, lateral view of middle femur; fig. 10, *congressus* male, lateral view of middle femur; fig. 11, *deformiceps* male, front view of head; fig. 12, *deformiceps* male, lateral view of head; fig. 13, *russipes* male, front view of head; fig. 14, *russatus* male, terminal antennal segments; fig. 15, *russipes* male, terminal antennal segments.

Odynerus tetralobus Bohart, new species

Male. Black marked with yellow as follows: Clypeus, first antennal segment in front, margin of pronotum broadly, tegula and spot beneath, stripes across scutellum and post-scutellum, lateral spot on propodeum, legs partly, apical bands on first five tergites and second sternite, attached lateral spots on first two tergites. Tarsi, tibiae partly, wing veins, brownish; apical cell of forewing and costal margin clouded, membrane otherwise mainly clear.

Pubescent short, pale, and obscure. Puncturation moderate, punctures mostly separated by at least one puncture diameter, clypeus well punctured. Head broader than long; clypeus roundly incised apically, emargination less than distance between apical teeth; third antennal segment about twice as long as second, last segment flattened and twice as long as broad; interocellar and ocular swellings prominent and shiny. Humeral angles approximately 90 degrees; middle femur strongly flattened and much broader basally than trochanter. Length to apex of second tergite, 7.5 mm.

Female. Clypeus dark-margined laterally, head markings reduced in size; scutellum two spotted. Clypeus sharply toothed and roundly incised apically; length to apex of second tergite, 8 mm.

Holotype male, Coalinga, Fresno County, California, May 14, 1938 (M. A. Cazier); allotype female and two paratype females, Riverside, Riverside County, California, May, on *Eriogonum fasciculatum* (P. H. Timberlake); male paratype, Gavilan, Riverside County, California, May 31, 1937 (P. H. Timberlake); female paratype, Mint Canyon, Los Angeles County, California, May 25, 1937 (E. P. Van Duzee). Paratypes in collections of P. H. Timberlake and the author.

Although resembling *congressus* closely in markings, *tetralobus* is a larger species with much more prominent head swellings. Also, the male last antennal segment in the former is slender and nearly cylindrical, whereas that of *tetralobus* is stout and flattened. The male middle femora are similar, but more flattened and swollen in *tetralobus*.

Odynerus martini Bohart, new species

Male. Black marked with whitish as follows: Clypeus, mandible partly, Y-shaped interantennal spot, first antennal segment in front, lower orbital stripe, postocular spot, front margin of pronotum, tegula and spot beneath, stripes across scutellum and postscutellum, lateral spot on propodeum, legs partly, apical margins of first four tergites and second sternite, free lateral spot on second tergite. Mandible mostly, antenna beneath and apically and second sternite partly, reddish; wing veins brown, membrane unclouded except slightly in apical cell. Pubescence short, pale, and obscure. Puncturation moderate, punctures mostly separated by about a puncture diameter; clypeus well punctured. Head broader than long; clypeus narrowly and angularly incised apically; interocellar and ocular swellings prominent and shining; third antennal segment about twice as long as second; last segment slender, curved, and nearly three times as long as broad. Humeral angles obtuse; middle femur strongly flattened and concave on outer side. Length to apex of second tergite, 6 mm.

Female. Clypeus black except for a subapical spot, whitish markings of head reduced, legs black and red, propodeum largely red, first three tergites and second sternite apically banded, free spot of second tergite faint and reddish. Clypeus angularly incised at apex; length to apex of second tergite, 7.5 mm.

Holotype male, Davis Mts., Texas, May 13, 1937 (J. O. Martin); allotype female, Finlay, Texas, July 2, 1930 (J. O. Martin). Paratype male, Sierra Blanca, El Paso County, Texas, July 8, 1917. Two female specimens which are probably this species are from Greeley, Colorado, June 6, 1902, and Las Cruces, New Mexico, respectively.

This species resembles *russatus* closely in general structure and markings. These are the only two species of the group, with the exception of *russipes*, having extensive light reddish markings. Although the females are practically indistinguishable, the males differ both in antennae and middle femora as indicated in the key. In addition the clypeus of *russatus* male is roundly instead of angularly excavated. This difference is much less obvious in the females. The head swellings in these two species are prominent but never reach the extreme knob-like condition found in most *congressus*. The supposedly *martini* female from Las Cruces has the body mostly reddish and undoubtedly the extent of red coloration is highly variable. As mentioned elsewhere, occasional specimens of *congressus* and *infuscipennis* have dark reddish showing up in the nodal area, and *russipes* is normally red-noded in the female only.

Odynerus russatus Bohart, new species

Male. Red marked with whitish as follows: Clypeus, face mostly, postocular spot, pronotum in front, tegula and spot beneath, stripes across scutellum and postscutellum, lateral spot on propodeum, legs partly, apical bands on first, second, fourth and fifth tergites and second sternite, a lateral attached spot on first tergite, a free lateral spot on second tergite. Scutum, wing veins, apices of terminal tergites, dark reddish brown; wing membrane mostly clear, apical cell clouded. Pubescence short, pale, and obscure. Puncturation moderately coarse, punctures mostly separated by at least a puncture diameter, clypeus sparsely punctured. Head slightly broader than long; clypeus roundly and deeply incised apically; third antennal segment about twice as long as second; last segment flattened, hardly twice as long as broad, and with the tip excavated (see figure). Aedeagus very broad and stout, hardly constricted sub-basally (see figure); paramere hairless except at inner base. Length to apex of second tergite, 7 mm.

Female. Clypeus irregularly marked with red, facial marks reduced in size, no interocellar marks, legs almost entirely red. Clypeus with a somewhat angular, narrowly rounded apical incision; length to apex of second tergite, 8 mm.

Holoype male, allotype female, and one male paratype, San Felipe Creek, Imperial County, California, July 8, 1933 (H. S. Gentry). Other paratypes, one male, Buckeye, Arizona, March 18, 1934, on *Lycium torreyi* (P. H. Timberlake); one male, Tucson, Arizona, July 25, 1940, on *Lycium parviflorum* (J. Bequaert); one male and two females, Indio, Riverside County, California, April 9, 1936, at flowers of *Prosopis* (P. H. Timberlake); one female, Indio, California, March 25, 1937 (G. E. and R. M. Bohart). Paratypes in collections of P. H. Timberlake, J. Bequaert, and the author.

Considerable variation exists in the extent of the red coloration which may be supplanted with black except in the nodal area. Apparently there is a seasonal variation with the redder forms emerging in midsummer. The peculiar male antennae separate the species at once from all others. The female may be confused with *martini* which is, however, a more easterly species.

ODYNERUS CONGRESSUS Viereck

Odynerus congressus Viereck, 1908, Trans. Amer. Ent. Soc., 33:405. (Holotype female, Univ. Kansas.)

Black marked with whitish which is distributed about as in *russatus* except that propodeum and scutellum are usually unmarked and second tergite lacks free spots; nodal area rarely marked with dark reddish. Similar in structure to *russatus* except that head swellings are usually greatly enlarged and extending down the face. Also, last antennal segment of male stout and flat but not excavated apically, and male middle femur concave on outer side and strongly flattened.

Records. Arizona: Bill Williams Fork, Phoenix, Higley, Congress Junction (type locality), Palmerlee, and Tucson (June to August). Texas: Sierra Blanca, El Paso County, July 8. New Mexico: Florida, July 6, on *Actinella* (T. D. A. Cockerell). California: Morongo Valley, San Bernardino County (September); Coachella Valley, Riverside County (May to August); Imperial County (April to November). P. H. Timberlake records it visiting the flowers of *Acacia greggii*, *Prosopis juliflora*, and *Croton californicus* in the Coachella Valley of California.

Odynerus russipes Bohart, new species

Male. Black; labrum, clypeus, mandible mostly; first antennal segment in front, triangular interantennal spot, ocular spot, front margin of pronotum, tegula mostly, spot below, stripe across scutellum, legs partly, apical bands on abdominal tergites one to five and sternites two to four, lateral spots on tergites one and two, whitish; tip of mandible, antennal flagellum, wing veins, tibiae and tarsi partly, last three abdominal segments mostly, reddish brown. Pubescence pale, obscure, and sparse; clypeus hardly silvered. Puncturation moderately thick, punctures mostly separated by one puncture diameter or slightly less. Head enlarged behind eyes but without smooth swellings; mandible five toothed, second tooth most protruding; clypeus deeply and roundly incised apically; third antennal segment less than twice as long as second; last two segments nearly equal in length, the last about twice as long as broad. Humeral angles obtuse; middle femur normal. First abdominal segment broadening abruptly subapically as viewed from above; aedeagus slender and with a long narrowed subapical neck; paramere densely hairy, especially on inner side. Length to apex of second tergite, 6.5 mm.

Female. Clypeus black; interantennal spot long oval; apex of postscutellum, propodeum, and base of first antennal segment, red; first three tergites and sternites two and three apically white banded. Head longer than broad as viewed from the front, clypeus roundly incised; second abdominal segment longer than broad; length to apex of second tergite, 8 mm.

Holotype male, Westgard Pass plateau, Inyo County, California, May 3, 1937; allotype female, same locality, May 27, 1937. Paratype male, Globe, Arizona, July 4, (D. K. Duncan); two male paratypes, Charleston Mt. Park, Nevada, May 24. Other paratypes (all from Inyo County, California): two males and one female, Inyo Mts.; six males and one female, Mazurka Canyon; one male, Panamint Mountains; one male, Westgard Pass plateau; one male, Little Lake. Paratypes in collections of U. S. National Museum, J. Bequaert, and the author.

The species can be readily distinguished by its unfurrowed and unswollen interocellar area, the whitish scutellum but dark postscutellum, and the lengthened head. In the last-named character it approaches *platycerus* and *deformiceps*, to both of which it is probably related. It is apparently a connecting link between these odd species and the more typical members of the group. The sexual dimorphism of *russipes* is striking, the female being red-noded.

Odynerus platycerus Bohart, new species

Male. Black; clypeus, first antennal segment in front, interantennal spot, orbital spot, postocular spot, front margin of pronotum narrowly, tegula mostly, stripe across scutellum, legs partly, apical bands on first six tergites and sternites two to four, yellow; spots on second to eleventh antennal segments, last two segments entirely, legs partly, reddish brown; terminal segment of tarsi dark, others light; wings deeply brown-stained. Pubescence short, thick, and pale to golden. Puncturation close and moderately coarse, punctures mostly nearly contiguous, clypeus well punctured. Head longer than broad, cubical; clypeus broad and semi-circularly emarginate apically; third antennal segment about twice as long as second; last two segments lengthened, last segment large, flat and spoon-shaped; mandible three toothed, basal tooth very large. Front margin of pronotum with a projecting membranous edge, lateral angles slightly obtuse; hind face of propodeum with a sharp lateral tooth instead of a ridge; middle femur of irregular shape, swollen basally and depressed externo-medially. First tergite slightly flared apically in dorsal view; second tergite longer than broad and apically reflexed collar-like; second sternite with a sharp latero-medial tubercle; genitalia about as figured for *deformiceps* but aedeagus slightly stouter. Length to apex of second tergite, 10 mm.

Holotype male. Guadalajara, Mexico, July, 1909 (D. L. Crawford).

This peculiar species resembles *deformiceps* but lacks the head swellings.

Odynerus deformiceps Bohart, new species

Male. Black; clypeus, first antennal segment in front, interantennal spot, orbital spot, postocular spot, front margin of pronotum, tegula mostly and spot beneath, stripes across scutellum and postscutellum, lateral spot on propodeum, legs partly, apical bands on first six tergites and second to fourth sternites, lateral attached spot on first tergite, pale yellow; spots on second to eleventh antennal segments, last two segments entirely, legs partly (last segment of tarsi dark), tegula partly, reddish brown; wings stained with brownish. Pubescence short, fairly sparse, and pale to fulvous. Puncturation moderately coarse, especially on abdomen where punctures are nearly contiguous; vertex weakly punctured; clypeus finely punctured. Head longer than broad and greatly swollen in ocellar area; third antennal segment about twice as long as second; last segment very large, flat and spoon-shaped (see figure); mandible three toothed, basal tooth very large, clypeus broad and semi-circularly emarginate apically; ocular and interocellar tubercles extremely prominent; ocelli reduced; post-

ocellar area long and nearly flat in lateral view. Front margin of pronotum with a projecting membranous edge, lateral angles slightly obtuse; hind face of propodeum with a sharp lateral tooth instead of a ridge; middle femur of irregular shape, swollen basally and depressed externo-medially. First tergite flared apically in dorsal view; second tergite longer than broad and apically reflexed collar-like; second sternite with a sharp latero-medial tubercle; genitalia as figured. Length to apex of second tergite, 11 mm.

Female. Clypeus about as long as broad and black except for a basal crescent, head swellings less prominent than in male, second sternite without tubercles.

Holotype male, Cochise County, Arizona, August 14, 1916 (Virgil Owen); allotype female, Palmerlee, Arizona, October. Paratypes (all from Arizona): three males, Ramsey Canyon, Huachuca Mts. (W. H. Mann); one male, Palmerlee, Arizona. Paratypes in collections of U. S. National Museum, J. Bequaert, and the author.

This extraordinary insect was placed in this group only after considerable deliberation and the discovery of the related species, *platycerus*, which links it to *russipes*. It is remarkable for its oddly shaped head and long slender body as well as for the numerous distinctive secondary sexual characters of the male.

Habits of Tiphia shastensis

On May 29, 1941, near Old Station, Shasta County, California, a large number of fresh emergence holes of the scarab beetle, *Phyllophaga errans* Lec., were noted along the edge of a little used dirt road. A closer examination revealed many females of *Tiphia shastensis* Krombein digging into and emerging from the ground as well as a few males following them about and attempting copulation. The female wasps flew rarely but wandered over the ground exploring the surface with their antennae. After a relatively short search they began to burrow into the ground vertically and within a few moments they would be out of sight. A small amount of excavation revealed several additional wasps and a larva of *P. errans*, suggesting the possibility that the tiphiids are parasites of the latter.—E. G. Linsley and C. D. Michener.

REVISION OF THE TERMITAPHIDIDAE
(Hemiptera)

BY ROBERT L. USINGER
University of California, Davis

Knowledge of the termitophilous genus *Termitaradus* has been at a standstill since the last of Myers' excellent papers (1932). Myers (1924) first recognized the genus as distinct from the monotypic *Termitaphis* of Colombia and gave a "key to the females of the seven adequately described species." In 1932 he was able to give a redescription of the eighth species, *australiensis* (Mjöberg), describe a new species from Jamaica, and describe the eggs of *guianae* (Morrison). Unfortunately a revised key was not given at that time, probably because of the uncertain status of the two Trinidad species, *trinidadensis* and *insularis* described by Morrison in 1924.

The two Trinidad species (both based upon single specimens collected at the same time and place in galleries of the same species of termite) have long been a source of confusion and have occupied isolated positions in Myers' classification; *trinidadensis* because of its small number of abdominal flabella (4 instead of the usual 6 or 8) and *insularis* because of its small number of body lobes (12 instead of 13 or 14 as in all other *Termitaradus* females). However, Myers' work (1924) strongly suggested that the number of body lobes varied between 13 and 14 (both forms were present in his series of *panamensis*) and he even had an incipiently 12-lobed female of *jamaicensis* in 1932. Furthermore, he showed that there were only four marginal flabella to each abdominal lobe in the penultimate nymphal instar of *jamaicensis*.

Through the kindness of Dr. A. M. Adamson of the Imperial College of Tropical Agriculture in Trinidad, I recently received a collection of sixty-nine specimens of *Termitaradus* from Trinidad and Tobago, B. W. I. Specimens were collected by Dr. Adamson at the following localities: Manzanilla, Trinidad, May 24, 1936 (34 specimens); Caura Valley, Trinidad, January 1, 1936 (12 specimens); Mayaro, Trinidad, May 10, 1936 (6 specimens); Caledonia District, Tobago, December 27, 1938 (3 adults and many eggs); and Bacolet, Tobago, September 13, 1938 (14 specimens). This fine collection includes eggs, nymphs of vari-

ous instars, and adult males and females. Dr. Adamson tells me that of the 150 or more species of termites in Trinidad he finds *Termitaradus* only in the galleries of the one species, *Heterotermes tenuis* (Hagen), where they are apparently quite common.

A study of this fine series of specimens sheds considerable light on the limits of variation in *Termitaradus* and settles the status of the doubtful Trindad species. It now seems obvious that the basic number of lobes on either side of the body is 14 but that 13- and even 12-lobed females occur within the same species. The number of marginal lobules and flabella is very variable on the thoracic lobes but is more constant on the middle lobes of the abdomen and is very constant on the head lobes and on the lobes of the eighth abdominal segment. This last character is so constant and the three-lobule condition occurs so consistently throughout all of the American species in contrast to the two lobules and flabella of the Old World species that one is tempted to reject the record of *mexicana* (2-lobules) as an error in observation. Certainly this is an inconsistency that should be checked when the type or other material is examined.

It seems certain that *trinidadensis* (Morrison, 1923) is the nymph (2 mm. long and 4 marginal flabella on either side of most of the abdominal segments) and *insularis* (Morrison, 1923) is the 12-lobed adult female of a single species. I have nymphs with 4 marginal flabella which are about 1.75 mm. long and, as mentioned above, 12-lobed females are also present in my series. The differences in shape of flabella illustrated by Morrison (1923) fall within the extremes of variation seen in a single individual, though the typical form lies between these two. The name *trinidadensis* is retained with *insularis* as a synonym because it has page precedence, is more appropriate, and corresponds to other geographical specific names in the genus.

The specimens from Trinidad and Tobago have been carefully compared and appear to be identical although the Tobago specimens average slightly smaller. The flabella of the second cephalic lobes are much smaller than those of the other body lobes in *trinidadensis* and one Tobago specimen has these flabella so short that they project beyond the margins of the lobules only at their rounded apices.

Male Termitaphidids are typically 12-lobed, the meso and metathoracic lobes being fused. As pointed out by Myers (1924), they seem to average one more lobule and flabella to each of the

anterior abdominal lobes than in the female of the same species. Males have not been incorporated into the classification because they are known only for *annandalei*, *guianae*, *panamensis*, and *trinidadensis*, they lack the very useful differentiating character of 2 or 3 lobules and flabella on the eighth abdominal lobes, and they differ from the females in average number of flabella on the other abdominal lobes. On the other hand, the flabella are similar in form in both sexes so it is a simple matter to associate the two sexes of a single species. The male genital capsule is very conspicuous, quite fully exposed, and may eventually provide characters for specific differentiation. The basal plates of the aedeagus are completely fused, thus differing from the Aradidae as described by Singh-Pruthi (1925), and the conjunctiva is sclerotized on either side into a plate with a recurved hook. The parameres are long, slender, tapering, and sinuous, being gradually curved near the middle and slightly recurved near the apex.

The eggs are similar to those described by Myers (1932) for *guianae*, being .87 mm. long and .55 mm. across greatest width. This is in spite of the considerably larger size of *trinidadensis* adults. The chorion is very thin, completely transparent, and finely pitted under magnification of 108 diameters. Beneath the chorion is the usual embryonic envelope which is discernible only upon dissection. As noted by Myers, no cap or micropylar processes are developed.

The food habits of the Termitaphididae are still a matter for conjecture but China (1931) called attention to the parallelism in structure of mouthparts (coiled setae) in the Plataspidae, Aradidae, and Termitaphididae and showed that this is a specialization for feeding on the mycelia of fungi. In 1936 I recorded a termitophilous Aradid, *Mezira reducta* Van Duzee, found commonly in the galleries of *Zootermopsis nevadensis* (Hagen). Since Hendee (1933) has shown that fungi are normally found in abundance in the galleries of termites and are rare or absent in sound wood, it seems obvious that the *Mezira* mentioned above and the Termitaphididae in general feed upon fungi associated with termite galleries.

A revised key to the Termitaphididae has been prepared based upon Silvestri's original key (1911) and the subsequent revisions of Morrison (1923) and Myers (1924). One female of *Termitaradus panamensis* Myers and two females of *guianae* (Morrison) were available for study and comparison thanks to

Mr. H. G. Barber, who also examined the types of *trinidadensis* and *insularis* in the collection of the United States National Museum and confirmed the critical characters at my request. I might add that the entire problem of the taxonomy of the present material was first referred to Dr. Morrison who turned the matter over to Mr. Barber. Thanks are due to the authorities of the United States National Museum and to both of these men for their cooperation.

Synoptic Key to the Termitaphididae

ADULT FEMALES

A. Body egg-shaped, surrounded by a strongly incurved and upcurved, dorso-lateral, segmentally divided lamina, the edges of which are further divided into distinct, often quite distantly separated lobules, each with a long, fine almost smooth flagellum. Colombia. (*Amitermes foreli* Wasmann; fam. Termitidae) ..... **Termitaphis circumvallata** Wasmann (1902)

B. Entire body strongly flattened above and below and surrounded by a flat, lateral, segmentally divided lamina the margin of which is crenulate, forming short, non-separated lobules, each provided with a short, circular, clavate, or lanceolate flabellum with serrate edges. Tropicopolitan. (In association with termites of the family Rhinotermitidae.) **Termitaradus** Myers (1924) (Type: *Termitaradus panamensis* Myers, 1924).

1. Flabella short and rounded, at most scarcely more than twice as long as broad 2

–. Flabella elongate, much more than twice as long as broad 5

2. Eighth abdominal lobes each with two lobules. Anterior abdominal segments normally with seven or more lobules on each side 3

–. Eighth abdominal lobes each with three lobules. Anterior abdominal segments normally with six lobules on each side 4

3. Flabella rounded. Anterior abdominal segments with not more than seven lobules on each side. Mexico. (*Heterotermes tenuis* Hagen) ..... **mexicana** (Silvestri, 1911)

–. Flabella short, clavate. Anterior abdominal segments with eight or more lobules on each side. India. (*Coptotermes heimi* Wasmann) ..... **annandalei** (Silvestri, 1921)

4. Flabella of second cephalic lobe half the size of other head and body flabella, but projecting conspicuously, ovate in form. British Guiana and Colombia. (*Heterotermes crinitus* Emerson and *tenuis* Hagen) ..... **guianae** (Morrison, 1923)

–. Flabella of second cephalic lobe much smaller, minute, scarcely surpassing margins, perfectly circular in form. Jamaica. (*Heterotermes convexinotatus Snyder*) .. **jamaicensis** Myers, 1932

5. Eighth abdominal lobes each with two lobules.....6
–. Eighth abdominal lobes each with three lobules.....7
6. Flabella subcylindrical, rounded at apices or at most very obtusely pointed, echinate. Anterior abdominal lobes each with seven lobules. Africa. (*Rhinotermes putorius* Sjöst.).....
.....**subafra** (Silvestri, 1911)
–. Flabella long, narrow, clavate, with straight sides and squarely truncate tips, not echinate. Anterior abdominal lobes each with eight or more lobules. Australia. (*Copotermes acinaciformis* Froggatt).....**australiensis** (Mjöberg, 1914)
7. Flabella lanceolate, very acute at apices. Panama. (*Heterotermes tenuis* Hagen and *convexinotatus* Snyder).....
.....**panamensis** Myers, 1924
–. Flabella moderately clavate, rounded at apices. Trinidad and Tobago. (*Heterotermes tenuis* Hagen).....
..... **trinidadensis** (Morrison, 1923)
(= *insularis* Morrison, 1923)

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A NEW MIRID FROM OREGON
(Hemiptera)

BY TSAI-YU HSIAO
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Lopidea oregona Hsiao, new species (fig. 1)

Coloration suggestive of *L. picta* Kngt., but distinguished from it and its allied species by the simple male right genital clasper and the long third antennal segment which in the male is nearly as long as the second segment.

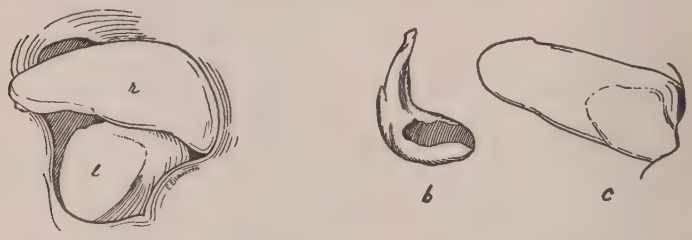

Figure 1. *Lopidea oregona* Hsiao, male genital claspers: a, both claspers, caudal aspect; b, left clasper, lateral aspect; c, right clasper, lateral aspect.

Male. Length, 4.9 mm., width, 1.505 mm., clothed with fine pale pubescence; dorsum fuscous; lateral margins of vertex, middle of frons anteriorly, genae, juga, lora (except apex), a longitudinal median line and anterior margin of pronotum, a broader longitudinal median line of scutellum, and embolar margins posteriorly, pale and slightly tinged with pinkish; base of vertex, frons, clypeus, and calli of pronotum, blackish; ventral side unevenly fuscous; gula, xyphus, propleura, first rostral segment dorsally, and anterior coxae, pale. Antennae black. Legs fuscous and tinged with reddish at the paler areas.

Head, width, 1.208 mm., length, .385 mm.; vertex, width, .638 mm., distinctly depressed before posterior carina. Rostrum: length, 1.225 mm., reaching upon intermediate coxae. Antennae: segment I, length, .438 mm; II, 1.59 mm.; III, 1.575 mm.; IV, .385 mm. Pronotum: length, .823 mm., width at base, 1.4 mm., convex posteriorly, posterior and lateral margins moderately sinuate, humeral angles broadly rounded, calli prominent. Scutellum: length, .525 mm., width at base, .70 mm., moderately convex, finely trans-

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versely rugulose at middle. Hemelytra surpassing abdomen with apex of cuneus; corium: length, 2.27 mm.; cuneus: length, .70 mm., width, .35 mm.; membrane concolorous, finely rugulose. Tibial spinules fine and dark. Dextral genital clasper simple, leaf-like, length, .525 mm., width at base, .265 mm., with a rough-surfaced knob-like elevation at inner surface near apex.

Female. Very similar to the male in coloration, length, 4.725 mm., width, 1.4 mm.; length of antennal segments: I : II : III : IV = .42 mm. : 1.365 mm. : 1.138 mm. : .35 mm.

Holotype, male, SENECA, OREGON, July 11, 1935 (Joe Schuh), in collection of the California Academy of Sciences. Allotype, female, taken with the type, in collection of the California Academy of Sciences. Paratypes, two males and one female, taken with the type; three males and one female, REDMOND, OREGON, June 25, 1939 (K. W. Gray and J. Schuh); in collection of the Entomology Department of Oregon State College and collections of J. Schuh, H. H. Knight, and the author.

ON THE DATE OF PUBLICATION OF LAPORTE'S ESSAI

BY H. M. HARRIS

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The genera and species described by F. L. de Laporte, Comte de Castelnau, in his "Essai d'une Classification Systématique de l'Ordre des Hémiptères" have been dated by most taxonomists and bibliographers from 1832. In an effort to solve some questions of synonymy and priority I have recently had occasion to investigate the date of publication of the Essai, and have concluded that it did not appear until 1833, although the preceding parts of volume II of Guérin's Magasin de Zoologie, in which Laporte's Essai appeared, actually were printed in 1832.

The title page of the "deuxieme année" of the Magasin de Zoologie bears the date, 1832. The introductory paragraphs, however, are signed "Guérin, Paris, Mars 1833" and the opening sentences are—"Aujourd 'hui nous faisons enfin paraître les 11 et 12 livraisons du Magasin de Zoologie. Ces deux livraisons, qui ont été retardées des circonstances independantes de notre volonte, formant le complement de l'année 1832." This is followed by a "Table Methodique" of the species and genera

"decrits ou indiques dans l'année 1832." An examination of the Table discloses that none of the genera or species treated in the Essai is listed, although a species described on the page immediately preceding the Essai is given. Laporte introduces the Supplement of the Essai with the statement "Ce travail ayant paru successivement, feuille par feuille, . . . "

Thus in the Essai itself and in the volume of the journal in which it is published there is sufficient cause for doubting the 1832 date. Also it is made clear that the Essai appeared in parts. In his references to the Heteroptera, Westwood (Introd. Mod. Classif. Insects, 11:451, 1840) cites Laporte's Essai as dating from 1833 as he previously had given it in an address read before the Entomological Society of London on January 21, 1835.

An examination of the early volumes of the Annales de la Société Entomologique de France and the Entomological Magazine, both of which had their inception in 1832, sheds still more light on the matter. On page 111 of the Annales, volume I, 1832, in the report of the "Séance du 29 février, 1832," is the statement, "M. De Laporte lit un essai d'une nouvelle classification des Hémiptères." In volume II of the Annales, p. xxxiii, livraison 11 of Guérin's Magasin is listed among the works having been published since January, 1833; and on p. xlii, livraison 12 and 13 are noted as having appeared after April 1, 1833. Still later in this second volume of the Annales there is a list of works published by members of the Société Entomologique de France during 1833, which list includes Laporte's Essai.

In volume I of the Entomological Magazine, p. 305, there is a review of Guérin's Magasin de Zoologie in which the reviewer specifically mentions Laporte's Essai. This is in the third number of the volume, issued in April, 1833. In the fifth number of the same volume, issued in October, 1833, one finds Guérin's Magasin de Zoologie again reviewed in the "Notice of Entomological Works" and it is specifically noticed that "De Laporte's excellent Essay on the Hemiptera is concluded."

In the copy of volume II of Guérin's Magasin before me there is no indication of the livraisons. One surmises that Laporte's Essai was issued as livraisons eleven and twelve and perhaps the Supplement as thirteen (note: Guérin's introduction does not mention the thirteenth). In any case it seems clearly evident that no parts of the Essai were issued in 1832, and that a portion of it, but not all, appeared before April, 1833.

A NEW EMPIS OF THE SUBGENUS PACHYMERIA
(Diptera, Empididae)

BY MAURICE T. JAMES
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In *Genera Insectorum*, fasc. 185, Melander lists four nearctic species of *Empis* referable to the subgenus *Pachymeria.*

The subgenus may be characterized as follows. Short, robust, blackish-gray species; eyes of female broadly, those of male narrowly separated (contiguous in male *johnsoni*) and with small uniform facets; face broad; humeral, propleural, and metapleural bristles not unusually strong; dorsocentrals and acrosticals biserial or multiserial; legs short, robust, the hind femora more or less thickened; legs in both sexes not ciliated with flattened scales; fourth vein reaching wing margin; anal angle of wing not obtuse, more or less rectangular; abdomen short, broad, its segments without strong dorsal bristles.

The known nearctic species may be separated by the following key:

KEY TO THE SPECIES OF PACHYMERIA

1. Hind femora no longer than middle ones; male dichoptic.....2
–. Hind femora one-third to one-half longer than middle ones....3
2. Abdomen wholly shining black.....*brevis* Loew
–. Abdomen with distinct white pollinose markings, especially toward apex.....*pudica* Loew
3. Abdomen with pile, except on first segment, largely or wholly pale and with distinct grayish pollinose areas on all segments. .....*montiradicis* James, n. sp.
–. Abdomen wholly black—pilose and shining or with greatly reduced pollinose markings.....4
4. Antennal style one-third as long as third segment; male dichoptic .....*otiosa* Coq.
–. Antennal style one-half as long as third segment; male holoptic .....*johnsoni* Mel.

Empis (Pachymeria) montiradicis James, new species

Male. Head black, wholly dusted with grayish pollen except on oral margin, which is shining. Eyes in front of ocelli separated by approximately distance between paired ocelli; front broadening gradually above, suddenly below; face about three times width of narrowest part of front. Total length of antennae two-thirds height of head; length of first two segments combined a little less than width of face; ratio of three segments and arista 5:4:16:6; third segment lanceolate, two and a half times as long as its maximum width; antennae dull black, basal segments with

black pile. Bristles of vertex and occiput black; about twenty-five infraorbitals; numerous occipitals, not arranged in rows; pile long, yellow, sparse, more abundant below. Head as wide as high, slightly higher than long; proboscis almost twice height of head, yellow, base and sheath blackish, palpi and labella lemon-yellow; palpi with a few long black hairs in front. Thorax black, almost wholly covered with dense grayish pollen; mesonotum with four brown vittae, middle pair (between dorso-centrals and acrosticals) reaching approximately from suture almost to anterior margin, outer pair (outside dorso-centrals) greatly abbreviated in front but sometimes extending beyond suture; propleurals and metapleurals black, pleural sclerites of mesothorax bare; bristles and hairs of pronotum, mesonotum and scutellum black; four scutellars. Legs short; all femora thickened, one-fifth to one-fourth longer than their tibiae; front and middle femora of equal length, hind ones half again as long. Front femora brown to black, except at base and apex; middle and hind ones yellow to brown, paler above and behind; tibiae and tarsi yellow, hairs and bristles black. Wings hyaline; veins yellow; R_{2+3} slightly sinuate. Abdomen black, with grayish pollen; segment one with coarse black pile laterally; pile of other segments finer, usually yellow, often more or less black, longest on segment two; segment one with pilose areas shining; two to four shining except laterally and more or less at base, especially on the more posterior segments; five, six and all of venter pollinose. Venter without protuberances. Hypopygium short, appearing somewhat angular below; upper lamellae as long as hypopygium, twice as long as wide, elliptical, finely pubescent; aedeagus short, thick, flattened on basal half, when exserted, directed dorsally and forward to about apex of segment six, strongly contracted and recurved at tip; genitalia variably yellow to brown. Length, 6 mm.

Female. Similar except sexually. Front as wide as ocellar triangle; occipitals less abundant; pile and bristles of thorax and abdomen shorter; genitalia shining black.

Holotype, male, BOULDER, COLO., May 5, 1934 (James); author's collection. Allotopotype, female, BOULDER, COLO., May 25, 1933 (James). Paratopotypes, 27 males, 14 females, BOULDER, COLO., May 22, 1932 (James), May 28, 1933 (James), May 5 and 12, 1934 (James), May 25, 1938 (James), May 14, 1939 (Lanham). Paratypes: 2 males, 1 female, VALMONT, COLO., April 29, 1934 (M. and H. James); 10 males, 5 miles north of BOULDER, COLO., May 9, 1939 (Rodeck and Lanham); 2 males, 4 miles northwest of HYGIENE, COLO., May 15, 1937 (Lanham); 1 male, COLO. 2091, Foothills 6 miles west of FT. COLLINS, May 4, 1896 (Gillette); 5 males, 2 females, COLO., 1853, HORSETOOTH GULCH, April 23, 1895 (Gillette).

NOTES ON MIGRATIONS OF THE PAINTED LADY BUTTERFLY IN 1941

BY ANGUS M. WOODBURY, JOHN W. SUGDEN AND CLYDE GILLETTE
Salt Lake City, Utah

Dispersal flights of the Painted Lady or Thistle Butterfly, *Vanessa cardui* (L.) passing northward through Utah have been reported by J. W. Sugden (Pan-Pac. Ent., 13:109-110) for the years 1924, 1930, 1931, and 1935. C. B. Williams (Ann. Ent. Soc. Amer., 31:219-223) summarized available knowledge of their movements up to 1938. Dr. Charles H. Abbot of the University of Redlands, California, reported (Bull. Ecol. Soc. Amer. 22:13) that a March-April, 1941, Painted Lady Butterfly migration in California "proved to be of smaller numbers and shorter duration than the more conspicuous migrations of 1924 and 1926." Extensive flights of these butterflies during April and May, 1941, in several western states, particularly Utah, Arizona, Colorado, Nevada, Idaho, California and New Mexico have either been observed by the writers or reported to them by other observers.

Professor Victor E. Jones of the University of Idaho at Pocatello reported that a student of his had first noted the Painted Ladies in northward movement on April 19. If so, they may have passed through Utah without being noted. Woodbury first noted these butterflies in upper Houserock Valley, Arizona, near the Utah line on April 26. On the next day, April 27, about ten A.M., he found them in northeastward flight about ten miles south of Escalante, Garfield County, Utah.

The butterflies were flying low, mostly between two and six feet above the ground, but occasionally higher or lower. They tended to hold a constant level above the surface, but obstacles or depressions seemed to require some adjustment. Upon approaching a ledge or rise in the ground, a butterfly would often fly almost into it before turning its course to avoid it. Upon approaching a depression such as a wash, one would tend to soar off into space a short distance before adjusting its course downward to find the ground that suddenly dropped away.

The general course of flight was about northeast roughly paralleling the foot of the Aquarius Plateau which rises to the north and west of the valley about three to four thousand feet. Butterflies were watched as they approached a south-facing ledge

about 20-30 feet high that partly barred the way. Many of the butterflies, upon reaching the ledge, turned eastward along its face until they found a way around or over it, when they immediately resumed the northeasterly direction.

They were also watched as they approached a deep wash draining easterly. It was about 100 feet wide at top, 20 feet deep and 30 feet wide at bottom. Coming over the edge, they dropped downward and usually reached bottom about at the foot of the north bank, where they turned and followed eastward along the bank some distance before ascending it and resuming the northeasterly direction.

The butterflies came mostly one or two at a time but occasionally were seen in threes, fours or even fives. There was a breeze from the northeast and they were heading directly into it. They appeared to fly almost constantly at a rate of about 20 miles per hour (measured by automobile speedometer when paralleling them in flight), but this seems to have been a little faster than visual estimates yielded in other places. The altitude ranged between five and six thousand feet and air temperatures were about 62° to 64° F.

Two sample counts were taken to get estimates of numbers. One on a 30-foot front yielded 192 butterflies in 15 minutes. The other on a 100-foot front yielded 200 butterflies in six minutes. When reduced to comparable figures they averaged about 38 butterflies per minute on a 100-foot front, or about 2000 per minute on a mile front.

Investigation indicated that they were moving forward on an area at least five miles wide, but how much wider was not determined. It was estimated that, during the five hours of observation, approximately 3,000,000 butterflies passed by on the five-mile front. How long the movement continued was not determined.

Even though a vast majority of the butterflies were on the move in the same direction, a few individuals were observed loitering along the way. A rain of the previous day had left puddles here and there which seemed to attract occasional individuals to stop at the puddle edges as if to drink. The loiterer behavior was usually distinguishable from that of the migrant.

After leaving Escalante about three P.M., no butterflies were seen at any place in Escalante Canyon nor at any place going down the canyon toward Widtsoe on the west side of the plateau.

Air temperatures were much lower than at Escalante. Watch was kept for butterflies from Widtsoe to Salt Lake City (250 miles) but none were seen. It was late in the afternoon and they might not have been flying if present.

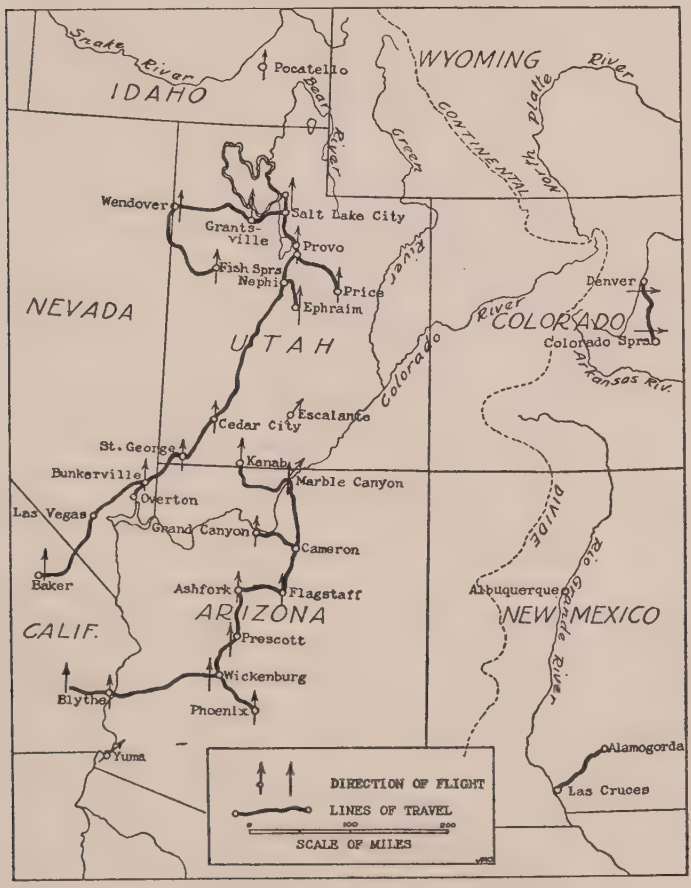

Fig. 1. Map showing observed emigrations of the Painted Lady Butterfly in the western states during 1941.

On the same date, April 27, 1941, Dr. V. M. Tanner (Great Basin Nat. 2:104) encountered large numbers of the Painted Lady Butterflies in northward migration between Kanarra, Iron County, and Anderson's Ranch, Washington County, Utah. From

Hurricane to St. George, many were seen flitting about but were not noted in emigrational flight.

The next day, April 28, Gillette left Salt Lake City for an extended trip through Utah, Arizona, California and Nevada. Painted Lady Butterflies were first observed at Nephi, Juab County, about 90 miles to the south about ten A.M. when air temperatures were rapidly rising. They were as usual flying one or two at a time (sometimes more) close to the ground in a northerly direction turning only to avoid obstacles.

They were noted flying in the same general northerly direction while the observer was traveling southward all the way from Nephi to Cedar City, nearly 200 miles. They were especially numerous about 12-15 miles southwest of Kanosh, Millard County, where a stop was made to collect specimens and estimate numbers in movement. As a result of counting it was calculated on the average that 75 butterflies per minute crossed the road within a distance at which the butterflies would be visible. This agrees in a general way with the estimates made at Escalante the previous day.

At Cedar City, butterflies were observed from the evening of April 28 to the morning of April 30. They were in northward flight during the warm part of the day, but the flight appeared to cease in late afternoon and did not resume until mid-morning the next day. During the resting period, they were observed sitting on flowers (dandelions, etc.) or sipping water from stream edges.

On the morning of April 30, no butterflies were seen between Cedar City and Toquerville but it is almost certain that those passing through Cedar City on the previous day must have come that way (the route where they were observed by Tanner on April 27). Going eastward from Toquerville through Zion Canyon, none were seen until the canyon was passed, but they were picked up again on the plateau to the east and were observed all the way through Kanab, Utah and Fredonia, Arizona, to the Kaibab Forest.

Here the butterflies thinned out a great deal, but nevertheless a few were passing northward through the open coniferous forest (Ponderosa Pine) on the Kaibab Plateau, despite the fact that there was still some snow left among the trees. The butterflies were passing between the tree trunks near the ground as usual and not above the tops of the trees.

From the east foot of the Kaibab Plateau across Houserock Valley to Marble Canyon Bridge spanning the Colorado River and on to Cameron, butterflies were observed all the way, but they appeared to be most numerous at the river near Marble Canyon Bridge. Here was a peculiar condition. The butterflies were flying north, which course took them across the top of the narrow Marble Canyon Gorge. By looking with field glasses down into the gorge from the bridge, it was noted that many butterflies were flying up the gorge in a direction somewhat north of east.

The next day, May 1, a trip was taken from the south rim of Grand Canyon, down the Bright Angel Trail to the Colorado River in the bottom of the canyon. Butterflies were not noticed in the early morning, but by the time the river was reached, they were noted going northward down the steep slopes toward the river, as usual keeping close to the ground.

At the river, many of them were noted turning up stream as if following up the gorge. Returning to the south rim in the afternoon, the observer met many butterflies coming down the slopes.

On May 2, butterflies were noted nearly all the way from Grand Canyon southward through Cameron, Williams, Ashfork, Prescott, and Wickenburg to Phoenix, Arizona. The altitude dropped steadily from near 7000 feet at Flagstaff to near 1000 feet at Phoenix, but still the butterflies were moving in regular fashion. At Phoenix, on May 3, most of the butterflies looked fresh and bright colored and did not seem to be battered, worn or frayed on wing tips.

More butterflies were observed the next day, May 4, in traveling from Phoenix, Arizona, to the California border at Blythe near the Colorado River, but they tended to decrease in numbers westward toward the river and but few were noted between Blythe and Los Angeles on the coast.

During several days' stay in Los Angeles, no butterflies were observed in transit, and it was not until Baker, California, was reached on May 9, on the return journey to Salt Lake City that they were again encountered in northward flight. From Baker to Las Vegas, Nevada, they were observed in movement, but from there to Cedar City, Utah, darkness overtook the travelers and no butterflies were observed.

At Cedar City, May 10, Gillette found the Painted Lady Butterflies still numerous and many of them still following the regular northward route. In contrast with the Phoenix butterflies which seemed fresh and active, many of those at Cedar City on this date were frayed and worn and looked old and shabby. During late afternoon travel to Salt Lake City, the butterflies were noted during the first part of the journey, but as afternoon faded into evening, no more were observed.

On April 30, the day Gillette went from Cedar City to Grand Canyon, Tanner found the butterflies in northward movement over Mormon Mesa between Bunkerville and Overton, Clarke County, Nevada. During the next few days (May 1-3) he observed them around Lake Mead but not in dispersal flight.

On May 1, the date Gillette was in Grand Canyon, two of Woodbury's students (Harold Higgins and Robert Pendleton) left Salt Lake City for Price, Utah (120 miles) to spend the week-end. Northward moving butterflies were observed through Lehi, Provo and Springville to the mouth of Spanish Fork Canyon. Going up the canyon eastward through the mountains 30 miles to Soldier Summit, they found the butterflies scarce, although some were seen in the vicinity of Thistle that might have come down a tributary canyon from the south.

Beyond Soldier Summit (east of the mountains) in Colorado River drainage, the butterflies were again encountered, especially in the open country from there to the head of Price River Canyon. None were observed in the canyon itself, but at Price, beyond the mouth of the canyon, they were again numerous and were observed on successive days until May 4, when the boys returned to Salt Lake City.

On April 30 and May 1, the days Gillette was along the Colorado River, Sugden observed them for the first time this year in Salt Lake City. They were not numerous but occasional individuals were seen. On May 2, Woodbury observed them in considerable numbers crossing the road which runs westward from Garfield to Grantsville, moving northward from Tooele Valley toward Great Salt Lake. They were noted at the same place on later trips over the same road on May 8, 9, and 10. By far the greater numbers were moving on May 8, and the numbers appeared to decrease on May 9 and 10. By May 13, when the next trip was taken, the flight seemed to have abated and only individuals indicating resident behavior were observed. An addi-

tional observation was made by Woodbury on May 5 when butterflies were observed moving northward along the east side of Great Salt Lake near the west foot of the Wasatch Mountains in the vicinity of Farmington.

Sugden also observed Painted Lady Butterflies in Salt Lake City every day from May 2 to 10. His notes indicate that they tended to increase slowly in numbers up to May 8 and then rapidly declined, which agrees closely with Woodbury's observations in Tooele Valley. He records that they were not too common on May 6, fairly common on May 7, more numerus on May 8, and not as numerous but with scattered butterflies about the city on May 10. When they were so numerous on May 8, he found them all the way east of the city up to the foot of the Wasatch Mountains, but did not find them in the narrow part of Parley's Canyon in the mountains. The flight here was typical of its flight elsewhere, most of them between two and ten feet above ground, flying generally northward, but varying somewhat northeast or northwest, or even east or west, but not directly south.

On May 9, Professor Jones personally observed them at Pocatello, Idaho, in northward flight. He commented that there were several *Vanessa carye*, West Coast Lady, mixed with *Vanessa cardui*. He also remarked that the weather had been so cold, blustery and stormy that it was doubtful if they could travel very far.

On May 11, Sugden made a trip from Salt Lake City westward through Grantsville to Wendover on the Utah-Nevada state line over U. S. highway 40, thence southward about 75 miles through Gold Hill to Fish Springs, Juab County, Utah, and northeastward back home to Salt Lake City. The butterflies were probably not flying when he passed through Grantsville (early morning) and he did not note any. Farther west and later in the morning, they were noted from time to time in northward movement until Wendover was reached, where they were still flying. An automobile which had presumably come from the west was observed to have many butterflies caught in the radiator, some fresh and others in various stages of drying, which led to the inference that butterfly movements were probably occurring somewhere in Nevada.

Butterflies were also noted in northward movement during the

trip southward to Fish Springs as well as on the return journey. It was noted, however, that at no place on the trip were moving butterflies very numerous when compared with the numbers observed in Salt Lake City on May 8. This region, however, borders the Great Salt Desert, an area of extreme drought and almost devoid of vegetation.

Additional data about the flight were obtained from Mr. H. W. Pickett who reported meeting a heavy flight between Santaquin, Utah County, and Nephi, Juab County, on May 5. They were especially numerous in the fields where "clouds" of butterflies passing across the road from one field to another so smeared his windshield that he had to have them scraped off. The next day, May 6, he encountered them again in San Pete Valley in the vicinity of Ephraim.

Further evidence of the widespread nature of the flight comes from a University of Utah field trip under the leadership of Wm. H. Behle and S. D. Durrant, on which butterflies were encountered on the Beaver Dam Wash in extreme southwestern Utah and northwestern Arizona on May 3, 4, 5, and 6. The butterflies were estimated to occur at intervals of 20 to 30 feet apart.

Additional evidence comes from Colorado. Victor F. Lotrich of the Colorado State Museum reports the following:

"On May 10 and 11, 1941, we noticed a migration of the painted lady along a front extending from Denver, Colorado, to Colorado Springs, Colorado. They were passing from the West in an easterly direction. The flight was against a stiff wind, and the butterflies flew low, seemingly in groups, although many individuals were noticed. On May 10th, the flight was continuous with the butterfly visible at all times. On May 11th the flight was scattering, but still was apparent along the front given above. In Colorado Springs a group of apple trees in bloom was watched. The painted lady stopped for a brief pause, seemingly to refresh itself, and then continued on its eastern journey."

"June 12, 1941, Nepesta, Colorado. We noticed the thistles and sunflowers, which due to much moisture were in profusion and growing rank in uncultivated areas. These plants had from one to several caterpillars each. It appeared to us that the migration of May 10 ended here, and that the painted lady flew to the extensive feeding found in the favorable soil provided by the wet climate of this spring. Further east along the Arkansas River the caterpillars were apparently absent."

Paul J. Klingenburg of the Soil Conservation Service located at Phoenix, Arizona, writes:

"My casual observation was that it was not abundant at Tucson or up the Santa Cruz Valley to the Mexican border. Dr. H. G. Johnston, Arizona State Extension Entomologist, tells me that the first occurrence of the migration was at Yuma with the direction of flight being generally northeast. Distribution was widespread in the Salt River Valley."

J. R. Eyer of State College, New Mexico, reported:

"I did observe large numbers of Painted Lady Butterflies, exceedingly abundant in the vicinity of Las Cruces, quite early in the spring, probably the latter part of April. These specimens for the most part were rather battered and rubbed, indicating either migration or that they had over-wintered here since last fall. They were feeding on early blooming members of the thistle family and on California Poppy. Owing to the fact that these were observed in the foothills of the Organ Mountains and on the desert between these mountains and Alamogordo, and due to the fact that they were feeding, I did not think of the flight as a particular migration, this species being rather abundant here each spring. However, the numbers were sufficiently large this spring to have accounted for such phenomena."

Prof. Wm. J. Koster of the University of New Mexico at Albuquerque noted during the last two weeks of May that butterflies were exceedingly numerous around the blooming rabbitbrush (*Chrysothamnus*) on the local "mesa" near the University.

This information appears to establish the Painted Lady Butterfly in northward dispersal flights in 1941 from March to mid-May on a front at least 800 miles wide, perhaps 1000, and traveling northward at least from Yuma, Arizona (near the Mexican border), to Pocatello, Idaho, about 700 miles. This need not necessarily imply that it was one continuous flight. It probably consisted of many parallel or tandem groups.

The evidence seems to indicate that the butterflies were more or less split by mountain chains although there is some indication that they do under some conditions pass over mountains or high plateaus. Gillette found them passing through the Kaibab Forest (8000 feet) in northern Arizona. Higgins and Pendleton found them on the high areas near Soldier Summit. Victor Lotrich found them going over a high mountain pass (Monarch

Pass, 11,386 feet) in Colorado on August 20, 1935, which he describes as follows:

"They were flying (westerly) in the general direction of Gunnison, Colorado. On the western slope, the butterfly was in countless numbers, and we watched them pass for two hours in a steady stream. The day was calm and balmy, the flight rapid, the butterfly visible from the ground to the tops of the trees. On the eastern slope the flight was slow going upwards toward the pass, and the butterfly was not grouped."

It seems possible that they may have come up from the south and have been squeezed between the main Rockies of the continental divide and the Sangre de Cristo Range where the two converge. It also seems possible that to get out of the funnel, they found an outlet over Monarch Pass into the Colorado Basin near Gunnison.

In some cases, they seem to have avoided deep canyons, especially those that cross their path, *e.g.*, Parley's Canyon (Sugden), Spanish Fork Canyon (Higgins and Pendleton) and Zion Canyon (Gillette). In other cases, deep canyons appear to be used as passageways, especially if the butterflies are not too much deflected from their course, *e.g.*, Marble Canyon (Gillette), washes and ledges near Escalante (Woodbury). Dry deserts, such as the flat wastes of the Great Salt Desert, do not block their passage and extensive water, such as Great Salt Lake, does not prevent their crossing as Sugden has observed them in other years not only on Antelope Island but also on Hat Island, far out in the lake.

The butterfly mode of travel seems to have a characteristic pattern, being more active during the warm parts of the day, slowing down in late afternoon and stopping altogether at night. This is probably conducive to inadequate observation since traveler is indistinguishable from loiterer except when in actual flight. The observations, *e.g.*, in New Mexico, of large numbers of loitering individuals do not prove dispersal flights; they merely indicate potential dispersal.

The origin and destination of the butterflies are not exactly clear from the evidence available but certain supplemental data give clues of some significance. On June 14, Woodbury noted that thistles on the north end of Antelope Island, Great Salt Lake, bore caterpillars of the Painted Lady Butterfly. On June 22,

Sugden found similar caterpillars on thistles at Murray and on the summit between Emigration and Parley's canyons, all within a few miles of Salt Lake City. Similarly Gillette found caterpillars on thistles in Salt Lake City and Woodbury found them still active on thistles high in Parley's Canyon on July 18. These observations are supplemented by those of Lotrich at Nepesta, Colorado, already reported.

It has been noted in all these observations, that nearly every thistle plant observed had been infested with the caterpillars. In contrast with tent caterpillars, which live in social groups (child families) and feed together on the same leaves (social territory), the Painted Lady caterpillars are solitary and have individual territories, each one usually consisting of a single spiny leaf, the edges of which are loosely rolled together and held in cylindrical form by silken threads. The caterpillar hides in this rolled leaf near the base (petiole) during the day and goes foraging over the leaf at night.

The number of caterpillars per plant varied considerably, ranging from one per plant to one per large leaf of the plant. The observations indicate that nearly every plant was quite thoroughly utilized, and barring interference by natural controls should produce a large crop of new butterflies. Presumably the eggs must have been laid as the adults passed by in their northward dispersal, which would provide a method by which widely dispersed host plants could be utilized on a grand scale.

Sugden noted near Murray on June 29 that many of the caterpillars were nearing maturity, some had left their rolled tubular leaves and one had reached the stage of pupation. On the same day, he noted that three caterpillars placed in a breeding cage on June 22 had pupated. Another caterpillar was successfully followed through pupation. It had, on the afternoon of July 1, attached itself by the posterior extremity. By next morning it had transformed into a pupa, very dark in color with yellow ventral spines. By July 3, the pupa had so faded that it was much lighter in color which continued until July 10, when the butterfly emerged. When liberated, it went directly to some nearby Delphiniums (Larkspur) where it continued feeding rapidly for a half hour before flying away.

The time required for larval development was not accurately determined, but may be estimated. Assuming that the first eggs

were laid in late April and the first pupation in late June, it then follows that under late spring and early summer temperatures, it takes about 60 days for egg and larval development and ten days for pupation. This would indicate at least 70 (possibly 90) days for the production of a new generation.

If these figures are accurate, they would seem to indicate a new midsummer generation in July or August. This raises two questions: What became of the parents who laid the eggs, and what is to become of the new generation? Since no records of southward return movements seem to have been recorded (as with the Monarch Butterfly), it seems reasonable to assume that the first generation of emigrants moving northward laid their eggs en route and finished their life cycle, after which they perished along the way.

If it is true that they do not make southward movements, then the new generation is destined to remain where they are or move northward in late summer as indicated, for example, by Lotrich's observation of movement over Monarch Pass on August 20, 1935.

Could it be possible that large areas of Arizona, New Mexico and Mexico act as reservoirs from which secular periodic outbreaks of large numbers of butterflies produce such population pressure that the northward movement takes place? If so, the reason for always taking the same direction (northward) is not clear. At any rate, it offers an outlet for some of the surplus population, where they find new host plants and raise new generations. Why the new generations do not persist in the new territory is also not clear, and appears to need further investigation.

The extent of the movements is so vast and the problems so great that the study of butterfly migration may need more intensive study than cursory and accidental observations can provide. Some responsible agency with adequate facilities should undertake more detailed investigations designed to establish the fundamental principles of such dispersal movements. This agency should be of national or international scope, such as the U. S. Fish and Wildlife Service, Division of Research, or the U. S. Bureau of Entomology. The person or persons assigned to the problem should have airplane and automobile facilities and permission to enter Mexico and Canada and should be free to follow the movements from origin to destination much as the duck flyways are now followed.

SOME COLLEMBOLA RECORDS FOR THE PACIFIC COAST AND A DESCRIPTION OF A NEW SPECIES

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This paper covers collection records of Collembola by the author during the past six years. The records for Oregon are incomplete but should be enlarged upon later when it is hoped that a more complete survey of Pacific Coast Collembola may be presented.

The springtail fauna of California, Oregon, and Washington is remarkably varied, extending from more or less subtropical forms to subarctic species. Literature on the Pacific Slope species is limited principally to papers by Schött, Bacon, Mills, Folsom, and a previous one by this author. An attempt has been made to include a fairly complete bibliography pertinent to the Collembola of this region.

The taxonomic system adopted here generally follows that employed by Börner (1905) and Mills (1934).

Suborder ARTHROPLEONA

Family PODURIDAE

Subfamily ACHORUTINAE

Achorutes armatus (Nicolet) 1841. Taken under boards, in moss, on stagnant water, on decaying oranges, and in greenhouses. California: Altadena, Jan.-Mar.; Montebello, Mar.; Santa Ana Canyon, Nov.; Oxnard, November.

Achorutes pseudarmatus Folsom 1916. Taken in gills of mushrooms and in moss and leaves. California: Altadena, Feb.; Washington: Snoqualmie Pass, May; Mt. Rainier, July; Wenatchee, May.

Achorutes brevispinus Harvey 1893. Under weed piles. California: Artesia, April.

Xenylla welchi Folsom 1916. On rain pools. Oregon: Portland, March.

Subfamily NEANURINAE

Tribe PSEUDACHORUTINI

Odontella ewingi Folsom 1916 (= *Xenylla helena* Scott 1937). Taken in fungus growth under bark of dead alder. This species, erroneously ascribed by the author in a previous paper to the genus *Xenylla*, was later discovered to be synonymous with the above. California: Angeles Crest, Los Angeles County, March.

Tribe NEANURINI

Morulina gigantea (Tullberg) 1876. In damp leaves under ferns. The definite record of this species at this time verifies several predictions that this very large Collembolan occurs in the Pacific Northwest. The only genuine record thus far for the Pacific Coast had been made by Folsom in Alaska. Oregon: Portland, May 15.

Neanura muscorum (Templeton) 1835. In damp leaves. California: Arroyo Seco, March and November.

Subfamily ONYCHIURINAE

Onychiurus fimetarius (Linnaeus) 1767. In damp leaves and in greenhouses. California: Altadena, Jan.-Mar.; Montebello, March.

Onychiurus armatus (Tullberg) 1869. In moss and damp leaves. Washington: Tacoma, April.

Onychiurus cocklei (Folsom) 1908. In deep moss and under stones. Washington: Mt. Rainier, July.

Tullbergia iowensis Mills 1932. Under damp boards. Oregon: Linnton, March.

Tullbergia collis Bacon 1914. Taken in deeply buried debris under rocks. California: Arroyo Seco (Los Angeles County), March.

Family ENTOMOBRYIDAE

Subfamily ISOTOMINAE

Folsomia guthrei (Linnaniemi) 1912. In damp leaves. California: Altadena, February.

Folsomia fimetaria (Linnaeus) 1758. On underground drain water. California: Altadena, January.

Agrenia bidenticulata (Tullberg) 1876. Taken in only one locality in damp moss at 6000 feet altitude. Washington: Stemilt Creek (Chelan County), June.

Proisotoma immersa (Folsom) 1924. Under damp bark. California: Arroyo Seco (Los Angeles County), April.

Proisotoma aquae (Bacon) 1914. On rain pools, in damp moss, and in leaves. California: Altadena, Jan.-Feb.; San Pedro, Feb.; Ontario, Oct.; San Antonio Canyon, Nov.; Santa Ana Canyon, Nov. Oregon: Portland, Feb.-March.

Proisotoma rainieri Folsom 1937. On surface of snow. Washington: Mt. Rainier, August.

Isotomurus palustris (Müller) 1776. On stagnant water. California: Altadena, Feb.-March.

Isotoma (*Vertagopus*) *cinerea* (Nicolet) 1841. In pine needles. Washington: Blewett Pass, May.

Isotoma (*Vertagopus*) *arborea* (Linnaeus) 1758. Taken under the loose bark of dead pine trees. California: Summit of Mt. Diablo (Contra Costa County), March.

Isotoma (*Pseudisotoma*) *sensibilis* Tullberg 1876. Under damp bark and in moss. California: Mt. Hamilton, Feb. Oregon: Portland, Feb.-March. Washington: Stehekin Valley, Sept.; Tacoma, April.

Isotoma viridis Bourlet 1839. Taken under the bark of trees, under boards and rocks, in leaves and moss, and in greenhouses. California: Altadena, Jan.; Idyllwild, Mar.; Santa Ana Canyon, Nov.; Mt. Wilson, Oct.-Nov.; Montebello, Mar. Washington: Wenatchee, May; Rock Island, November.

Isotoma viridis Bourlet var. *delta* Macgillivray 1896. Under bark of dead pine. California: San Antonio Canyon, November.

Isotoma viridis Bourlet var. *catena* Guthrie 1903. In damp leaves. Washington: Blewett Pass, May.

Isotoma gelida Folsom 1937. Under rocks along river banks and in moss. Oregon: Portland, February. Washington: Wenatchee, October.

Isotoma olivacea Tullberg 1871. In moss. Washington: Mt. Rainier, August.

Subfamily ENTOMOBRYINAE

Tribe ENTOMOBRYINI

Sinella curviseta Brook 1882. Under damp bark. California: Stanford University, February.

Sinella höfti Schäffer 1890. On surface of underground drain water. California: Altadena, January.

Sinella binoculata (Schött) 1896. Under logs and rotten wood. California: Madroñe Hot Springs, April; Stanford University, Oct.; Altadena, Mar.; Mt. Wilson, November.

Sinella sexoculata (Schött) 1896. Under damp bark. California: San Antonio Canyon, Feb.-Nov.; Arroyo Seco, Jan.-Mar. Washington: Tacoma, April.

Entomobrya cyanica Scott, new species

(Figs. 1-3)

Color: Entirely a cyanic blue except for lemon-yellow tibiotarsi, a striking yellow dorso-lateral saddle on mesonotum, and unpigmented dentes. The anterior and posterior margins of head also tend to be tinged with yellow. Antennae (fig. 3) robust, about 3 times the length of head. Segments in relative lengths as 4:14:16:18. Body thickly clothed with clavate hairs. Eyes—16. Unguis (fig. 1) typically entomobryan with a pair of basal lateral teeth and two or sometimes three pairs of inner teeth. Unguilicus unarmed. Tenent hair slightly longer than unguis. Dentes about one-fifth longer than manubrium. The coarse dorsal crenulations on dentes end at a distance from apex of about 3 times the length of mucrones. Mucrones (fig. 2) with two teeth and a basal spine. Length, 1.5 mm.

This species is so distinct in coloration that no comparison is possible with any forms known to the author. Taken under the bark of dead alder in March. Only five specimens were found over a five-year period. Type specimens are in the author's collection until such a time as they can be placed in the California Academy of Sciences. Type locality: ARROYO SECO, LOS ANGELES COUNTY, CALIFORNIA.

Entomobrya multifasciata (Tullberg) 1871. In damp leaves, in moss, and under bark. California: Mt. Diablo, Jan.-Mar.; Stanford University, Jan.; Altadena, Jan.-June; San Antonio Canyon, Feb.; Artesia, Mar. Oregon: Portland, Mar.; Troutdale, February.

Figures 1-3, *Entomobrya cyanica* Scott, n. sp.: 1, left forefoot; 2, right mucro; 3, antenna. Figures 4-6, *Sminthurides* (*Denisiella*) *sexpinnatus* Denis: 4, antenna; 5, left forefoot; 6, right mucro. Figures 7-9, *Orchesella cincta* (Linnaeus): 7, antenna; 8, right mucro; 9, right midfoot.

Entomobrya marginata (Tullberg) 1871. In moss and under logs. Washington: Tacoma, April; Blewett Pass, May; Wenatchee, May-June.

Entomobrya griseo-olivata (Packard) 1873. Under logs. Washington: Blewett Pass, May.

Entomobrya clitellaria Guthrie 1903. On stagnant water, under bark, and in damp leaves. California: Altadena, Feb.; Stanford University, Jan.; San Pedro, March.

Entomobrya purpurascens (Packard) 1872. Inside chili peppers attacked by pepper weevils and under strawberry vines, moss, and leaves. California: Artesia, Oct.; Downey, July; San Pedro, April. Oregon: Portland, Feb. Washington: Wenatchee, April.

Entomobrya suzannae Scott 1937. Taken under bark of damp, rotten logs. California: Alpine Creek, Nov.; Stevens Creek (Santa Cruz Mts.), Dec.; Calaveras Reservoir, February.

Entomobrya atrocincta Schött 1896. In damp leaves. Washington: Pullman, April.

Entomobrya washingtonia Mills 1935. Taken under damp bark, in dead leaves, in moss, and under rocks. California: San Antonio Canyon, Feb.; Arroyo Seco, Feb.; Calaveras Res. (Santa Clara County), Feb. Oregon: Portland, Feb. Washington: Tacoma, April; Wenatchee, May; Stehekin Valley, July.

Drepanura californica Schött 1891. Under damp bark. California: Altadena, Jan.; Arroyo Seco, Jan.; Madroñe Hot Springs, April.

Sira domestica (Nicolet) 1841. Taken in dry surroundings under bark of trees and in leaves. California: Stanford Univ., Nov.-April; Altadena, June.

Sira buski Lubbock 1869. Under damp leaves. Washington: Wenatchee, May-September.

Lepidocyrtus curvicollis Bourlet 1839. In moss. Oregon: Portland, February.

Lepidocyrtus purpureus Lubbock 1873. In damp leaves. California: Altadena, Jan.-Mar. Washington: Stehekin Valley, July.

Lepidocyrtus cyaneus Tullberg var. *cinereus* Folsom 1924. In moss. Oregon: Portland, January.

Pseudosinella octopunctata Börner 1901. In damp leaves. California: Santa Ana Canyon, November.

Pseudosinella sexoculata Schött 1902. Under damp bark and manure. California: Altadena, Jan.-Mar. Washington: Wenatchee, September.

Pseudosinella decemoculata (Guthrie) 1903. Under leaves and in damp wood frass. California: Altadena, Jan.-Mar.; Arroyo Seco, Jan.-March.

Pseudosinella violenta (Folsom) 1924. In damp leaves and soil. California: Altadena, Oct.-March.

Tribe ORCHESELLINI

Orchesella cincta (Linnaeus) 1758. (Figs. 7-9). In moss. Oregon: Portland, January.

Subfamily TOMOCERINAE

Tomocerus vulgaris (Tullberg) 1871. In leaves, under damp boards, and under bark. California: Alpine Creek (Santa Cruz Mts.), April and October. Washington: Wenatchee, June and October.

Tomocerus flavescens (Tullberg) 1871. Under damp bark. California: Alpine Creek (Santa Cruz Mts.), April. Oregon: Portland, January.

Tomocerus flavescens (Tullberg) var. *americanus* Schött 1896. In moss, under bark, and under rocks. California: Arroyo Seco, Mar. Washington: Stemilt Creek, July; Mt. Rainier, Aug.; Rock Island, Oct.; Stehekin Valley, July-October; Blewett Pass, May.

Tomocerus flavescens (Tullberg) var. *arcticus* Schött 1894. In moss and under bark. California: Madroñe Hot Springs, April. Oregon: Portland, Feb. Washington: Wenatchee, May; Rock Island, Oct.: Mt. Rainier, Aug.; Tacoma, April.

Tomocerus bidentatus Folsom 1913. Under bark of redwood stumps. California: Big Basin (Santa Cruz Mts.), February.

Suborder SYMPHYPLEONA

Family SMINTHURIDAE

Subfamily SMITHURIDINAE

Sminthurides (*Denisiella*) *sexpinnatus* Denis 1931. (Figs. 4-6). This unusual species has never been previously recorded in

North America. The colors of the specimens at hand vary somewhat from Denis' description. Taken on the surface of still, clear water of fish ponds. California: Altadena, March.

Arrhopalites caecus (Tullberg) 1871. Taken under damp bark of dead trees. Not common. California: Stanford Univ., Feb.; Altadena, February.

Sminthurinus aureus (Lubbock) 1862. In moss and on stagnant water. California: Arroyo Seco, Feb.; Altadena, February.

Sminthurinus elegans (Fitch) 1863. This species, so well described by Folsom (1934), is probably the same referred to by Gervais and Lubbock as *S. bourletii*. It was taken on the surface of stagnant water and in damp leaves. California: Altadena, Dec.-Mar.; Santa Ana Canyon, November.

Sminthurinus niger (Lubbock) 1867. In damp leaves and under damp bark. California: Big Basin, Feb.; Altadena, March.

Sminthurinus quadrimaculatus (Ryder) 1879. Under damp boards. California: Altadena, February.

Sminthurinus remotus (Folsom) 1896. On stagnant water. California: Altadena, Feb.-March.

Subfamily SMINTHURINAE

Bourletiella hortensis (Fitch) 1863. On stagnant water. California: Altadena, March.

Sminthurus fuscus (Linnaeus) 1746. Under damp boards, under bark, and in damp leaves. California: Altadena, Jan.; Santa Ana Canyon, Nov.; San Antonio Canyon, December.

Subfamily DICYRTOMINAE

Ptenothrix maculosa (Schött) 1891. A very common species in damp situations such as under boards, damp leaves, moss, in gills of mushrooms, and on the surface of stagnant water. California: Altadena, Dec.-Mar.; Alpine Creek, Dec.; Stanford Univ., Dec.; Mt. Wilson, Nov.; San Antonio Canyon, Nov. Oregon: Portland, Feb.-March.

Ptenothrix olympia (MacGillivray) 1894. Taken in damp moss and pine needles. California: Stanford Univ., Dec. Oregon: Portland, Feb.-April. Washington: Tacoma, April; Blewett Pass, May.

Ptenothrix vittata (Folsom) 1896. On flower pots in greenhouses. California: Montebello, March.

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NOTES ON SYNONYMY IN THE GENUS CERCERIS—I
(Hymenoptera, Sphecidae)

BY HERMAN A. SCULLEN
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During the summer of 1940 the writer spent some time studying the types of the genus *Cerceris* at the Museum of Comparative Zoology, the American Museum of Natural History, the Academy of Natural Sciences of Philadelphia, the United States National Museum and the University of Nebraska. As it will be some time before the writer will be in a position to publish a review of the genus[2], on which he is working, it was thought best to call attention to certain synonyms which became evident as a result of the above type studies.

CERCERIS MACROSTICTA Viereck and Cockerell

Cerceris macrosticta Viereck and Cockerell, Jour. N. Y. Ent. Soc., XII:133 (1904), ♂. New Mexico. A. N. S. Philadelphia type 10381.

Cerceris ampla Banks, Ann. Ent. Soc. Am., V:16 (1912), ♀, ♂. Fedor, Lee County, Texas (Birkman). M. C. Z. type 13769.

C. hebes Cameron (1890) appears to be very close to *C. macrostica* V. and C., but the illustration of the hypopygium of the former does not agree with the hypopygium of the latter.

CERCERIS DESERTA Say

Cerceris deserta Say, Long's Exped., II, App., p. 344 (1924), ♂. North West Territory, Mo., Pa. Type lost.

Cerceris fulvipes Cresson, Proc. Ent. Soc. Phil., V:126 (1865), ♀. Dela. (Dr. Wilson); Ill. (Dr. Lewis). A. N. S. P. type 1941.1.

Cerceris fulvipediculata Schletterer, Zool. Jahrb. II:492 (1887). (Name preoccupied by *C. fulvipes* Eversmann, 1849, Russia).

In the absence of a type the author is accepting the species recognized as *C. deserta* by E. T. Cresson, Sr., as the correct form. For some time we have been inclined to believe *C. fulvipediculata* was the female of *C. deserta* because they are almost always taken at the same time and place. The color pattern is very similar. A mated pair taken by J. R. Malloch at Medicine

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[2] Additional material belonging to the genera *Cerceris* and *Eucerceris*, especially from the southwest and Mexico, will be most welcome for study.

Hat, Alberta, was recently received with material from the National Museum. The male was a typical *C. deserta* and the female a typical *C. fulvipediculata.*

Cerceris morata Cresson

Cerceris morata Cresson, Trans. Am. Ent. Soc., IV:230 (1872), ♀. Texas (Belfrage). A. N. S. P. type 1944.

Cerceris nasica Viereck and Cockerell, Jour. N. Y. Ent. Soc., XII:132 (1904), ♀. New Mexico (F. H. Snow). A. N. S. P. type 10382.

Cerceris platyrhina Viereck and Cockerell, Jour. N. Y. Ent. Soc., XII:133 (1904), ♀. Fillmore Canon, Organ Mountains, N. M., August 29 (Cockerell). A. N. S. P. type 10384.

There are some slight differences in size, form and shade of color but these are all well within the range of variation common to species of this genus.

Cerceris prominens Banks

Cerceris prominens Banks, Ann. Ent. Soc. Am., V:19 (1912), ♀, ♂. Falls Church, Va., Sept. and October. M. C. Z. type 13790.

Cerceris alaope Banks, Ann. Ent. Soc. Am., V:22 (1912), ♂, ♀. Falls Church, Va., 5 June, on Ceanothus. M. C. Z. type 13784.

The male assigned to this species by Banks appears to be very close to those usually considered *clypeata* Dahlbom. If this male is the true male of *prominens* Banks it cannot be satisfactorily separated from males of the former species by the author without more careful study.

Cerceris convergens Viereck and Cockerell

Cerceris convergens Viereck and Cockerell, Jour. N. Y. Ent. Soc., XII:136 (1904), ♀. Alamogordo, N. M., May 13, 1902 (Viereck). A. N. S. P. type 10376.

Cerceris rinconis Viereck and Cockerell, Jour. N. Y. Ent. Soc., XII:137 (1904), ♀. Rincon, N. M., July 5, at flowers of *Chilopsis saligna.* A. N. S. P. type 10386.

Cerceris pudorosa Mickel, Univ. Neb. Studies, XVII:338 (1917), ♀, ♂. Auburn, California, September 20, 1916 (L. Bruner). Types at Univ. Neb.

After having studied a large series of this species from many parts of the west the author is convinced these are all the same.

Cerceris serripes (Fabricius)

Vespa serripes Fabricius, Species Insectorum, I:464 (1781), ♂. America borealis. Type in British Museum.

Cerceris bicornuta Guérin, Iconogr. règn. anim., VII:443 (1845), No. 3, ♀. New Orleans. Type in British Museum.

Cerceris dufourii Guérin, Iconogr. règn. anim., VII:443 (1845), No. 4, ♂. New Orleans, Louisiana. Type probably in British Museum.

Cerceris venator Cresson, Proc. Ent. Soc. Phil., V:116 (1865), ♂. New York (Angus); New Jersey, Pennsylvania (Cresson); Illinois (Dr. Lewis); Kansas (Dr. Wilson); Louisiana (Kennicott). A. N. S. P. type 1937.1.

Cerceris bicornuta Cresson, Rept. geogr. and geol. Explor. and Survey, w. 100th meridian, V:717 (1875).

Cerceris serripes Bequaert, Bull. Brooklyn Ent. Soc., XXIII:62 (1928), No. 43.

Credit for calling attention to the above synonymy should go to Cresson (1875) and Bequaert (1928). It was thought best, however, to bring this all together in one place at this time.

CERCERIS CLYPEATA Dahlbom

Cerceris clypeata Dahlbom, Hymen. Eur., I:221 and 500 (1845), ♂, ♀. America. Types in Zoological Institutionen, Lund, Sweden.

During the year 1931 the author had some correspondence with Dr. N. A. Kemner, Entomologist with the above Zoological Institutionen, for the purpose of verifying his determinations of *C. clypeata* Dahlbom. From Dr. Kemner's letters it would appear that this well-known species may be incorrectly named. Under date of February 12, 1931, Dr. Kemner wrote:

> " * * * we have the types of *Cerceris clypeata* Dahlbom here in the Museum. We have two good specimens from South Carolina and if you send us specimens of your collection we will compare them with the types."

A series of specimens representing *C. clypeata* Dahlbom as recognized by American workers was sent to Sweden for comparison. Under date of June 8, 1931, Dr. Kemner replied:

> "I have now compared your specimens of *Cerceris clypeata* Dahlbom with the types in the Dahlbom collection here, and have found that they are different species. The clypeal margin and the hair lobes in the male are quite different and also the clypeal process of the female."

Recognizing the confusion that would result if it became necessary to change the name of such a well-known species, the author felt it would first be desirable to secure more specific information. An additional shipment of specimens was sent for

comparison. From that date on, the author has been unable to get a reply from Dr. Kemner or to have the loaned specimens returned. It is the hope of the author that circumstances sometime will make it possible for some worker to clear up the question relative to *Cerceris clypeata* Dahlbom. However, until more positive information on the identification of the true species is at hand, the writer will continue to accept the name *C. clypeata* Dahlbom for the species commonly so recognized.

A NEW APTEROUS ARADID FROM AUSTRALIA
(Hemiptera)

BY CARL J. DRAKE
Iowa State College, Ames, Iowa

In a recent number of this Journal (Vol. XVII, p. 179, 1941), Dr. R. L. Usinger erected the genus *Chelonoderus* for *stylatus*, new species, from Australia. The present paper contains the description of a second member of this genus from Australia.

Chelonoderus hackeri Drake, new species

Apterous, large, elongate-obovate, broadly truncate behind (female), tumescent areas rather densely covered with thick, short, brownish, tomentose hairs, bottoms of depressions or pits largely smooth and without vestiture, also parts of some of the tumid areas. Head long, very broad through eyes, there the width and length subequal, strongly narrowed behind eyes, the median longitudinal portion rather broad, raised, tumid and convex; eyes exserted, ovate in outline, the stalk obliquely raised, produced behind hind margin of eyes for about one-half the longitudinal diameter of an eye, there tubercular-like and the hind margin sharply narrowed inwardly to main stalk; juga broad, strongly produced anteriorly, their tips turned inwardly and contiguous, thus forming a small notch at apex and enclosing a small open space in front of tylus; antenniferous tubercles very thick, long, divergent, bluntly rounded at apices, not quite reaching middle of first antennal segment. Antennae subequal to head in length, brownish black, sparsely clothed with short, thick, inconspicuous, appressed hairs; segment I slightly curved outwardly, strongly thickened on distal half; IV pyriform, the tip brown and rather densely clothed with long, fine, straight, golden hairs; proportions: I, 26; II, 14; III, 19; IV, 16. Rostrum brownish, nearly reaching apex of sulcus (base of head). Bucculae thick, blackish, swollen apically.

Pronotum broadly depressed in the middle anteriorly, with a

rather wide, median, longitudinal ridge on hind lobe; a small somewhat circular, tumid area on each side of this ridge; outer margins considerably swollen, the antero-lateral protuberances prominent, turned a little forward and obliquely upward, broadly rounded, extending laterally a little farther than eyes; collar distinct, narrow, ridge-like in form. Mesonotum distinctly wider and about two-thirds as long as pronotum, the outer angles slightly bent upward, protruding, bluntly rounded, and distinctly shorter than median longitudinal line of mesonotum; median, longitudinal area broad, convex, distinctly raised and widened posteriorly; a large, prominent, somewhat semi-globose tubercle on each side of central area. Metanotum subequal to pronotum in length, enclosed along outer margins by connexivum, the median portion becoming broader and very strongly raised posteriorly; very strongly depressed on each side of median area; a very large, high, prominent, somewhat knobbed-like protuberances arising from the central part of each lateral disc and projecting upward; a very deep, large, transverse pit in front and behind each protuberance, the anterior pit larger, deeper and includes part of hind portion of pronotum; hind margin of metanotum abruptly widened and not depressed within. Abdomen with median, longitudinal area raised, broad, convex; each tergite in general with four depressed areas or pits on each side:—namely, an elongate pit on side of median, raised area, a very large, circular pit near middle of lateral lobe and two much smaller pits near outer border. Connexivum broad, rugose, the outer margin sinuate; last segment without large depressions but with four rather large tubercular-like protuberances. Venter rugose and tomentose. Legs brownish black, sparsely clothed with thickened, yellowish brown, tomentose hairs.

Length: 10.20-11.50 mm.; width, 4.50-5.20 mm.

Type, female, MONTVILLE, AUSTRALIA, January, 1913, H. Hacker; and paratype, female, BUDERIM MOUNTAINS, AUSTRALIA, June 4, 1912, H. Hacker, in Drake Collection.

This species is named in honor of the collector who has spent a great deal of time studying and collecting Australian Hemiptera. *C. hackeri* differs from *stylatus* Usinger by not having the sixth and seventh segments of the abdomen distinctly lobulate laterally, shorter antenniferous tubercles, tuberculate lateral margins of pronotum, and the small, post-ocular tubercle. Some of the thick, tomentose hairs apparently have been rubbed off in both the type and paratype of *C. hackeri.*

The entire "Hacker Collection" of Hemiptera, which contains many rare and undescribed species from Australia, has been purchased by the author and is now incorporated as a part of his private collection.

A NEW SPECIES OF CALLIDIUM FROM THE COAST REDWOOD, SEQUOIA SEMPERVIRENS

(Coleoptera, Cerambycidae)

BY E. GORTON LINSLEY
University of California

Callidium sempervirens Linsley, new species

Male: Form oblong; color dark green, sometimes with a bluish caste; pubescence erect, black. Head coarsely, densely punctate, clothed with erect black hairs; antennae nearly three-fourths as long as body, scape very robust, at least twice as long as broad, distinctly excavated in front, second segment about half as long as scape, less than half as long as third segment, segments two to four incrassate at apex. Pronotum nearly twice as wide as long, narrower than elytra at base, sides broadly rounded; disk coarsely, closely, deeply punctate, without an amphora-like impression, lateral areas more deeply, rugoso-punctate; prosternum coarsely, deeply punctate, with an obtusely angulate smooth area before coxae and a similarly sculptured band along anterior margin. Elytra about twice as long as broad, about three times as long as pronotum, sides subparallel; surface coarsely, deeply punctate, pubescence short, suberect, black; apices obtusely rounded. Legs with femora very strongly clavate; tibiae slightly arcuate; posterior tarsi with first segment longer than following two together. Abdomen black; sternites finely punctate and pubescent, shining; fifth sternite shorter than fourth; apex broadly emarginate. Length, 10-12 mm.

Female. Antennae barely more than half as long as body, scape more slender; prosternum shining, finely, transversely rugulose; femora less strongly clavate; abdomen with fifth sternite longer than fourth, broadly rounded at apex. Length, 11-12 mm.

Holotype, male, No. 5218, Calif. Acad. Sci., Ent., allotype, female, No. 5219, and three male and one female paratypes, from SANTA CRUZ, CALIFORNIA, March 22, 1936, reared from the coast redwood, *Sequoia sempervirens*, by Mr. J. W. Tilden. An additional paratype, male, was collected by the writer on a redwood stump near Chabot Observatory, OAKLAND, CALIFORNIA, on April 7, 1926. Two paratypes are in the collection of Mr. Tilden, the remainder in the collection of the writer (deposited in the California Academy of Sciences).

This species is related to *Callidium sequarium* Fisher and *C. californicum* Casey but differs from both in the green coloration, heavy antennae and legs, and the transverse pronotum which is nearly twice as wide as long. Superficially it is suggestive of *C. antennatum* Newman but may be distinguished at once by the absence of the amphora-like pronotal impression, the sculpturing of the prosternum of the male, the color, etc.

Acanthasargus flavipes, 51.
gracilis, 51.
palustris, 51.
varipes, 51.
Achorutes armatus, 177.
brevispinus, 177.
pseudarmatus, 177.
Acmaeodera barri, 114.
ephedrae, 113.
Acroneuria delta, 72.
obscura, 72.
pacifica, 72.
pumila, 72.
Adamson, A. M., Trinidad, 42.
Aëdes cinereus, 80.
hirsuteron, 79.
idahoensis, 80.
increpitus, 79.
intrudens, 78.
pullatus, 78.
spenceri, 79.
Agapostemon c. vandykei, 137.
Agrenia bidenticulata, 179.
Amphibicorisae, 95.
Amphorophora nabali, 143.
osborni, 143.
Anabrus simplex, 5.
Ancyloscelis, key, 109.
maculifera, 111.
Andrena, note, Bohart, 39.
Yosemite species, 137.
Anisembia rubra, 40.
Anopheles pseudopunctipennis, 82.
Anthophora *ignava*, 28.
p. infernalis, 28.
p. pacifica, 28.
Anthophoridae, 28, 108.
Aonidiella aurantii, 82.
Aphididae, 143.
Apoidea, 28, 29, 39, 74, 108, 115, 119, 127, 136.
Aradidae, 83, 190.
Aradus ampliatus, 83.
apicalis, 84.
behrensi, 84.
blaisdelli, 85.
cinnamomeus, 86.
compressus, 85.
debilis, 85.
falleni, 86.
funestus, 85.
fuscomaculatus, 84.
heidemanni, 86.
linsleyi, 84.
lugubris, 85.
medioximus, 85.
orbiculus, 86.
patibulus, 84.
proboscideus, 84.
Armitage, H. M., Pyrausta, 39.
Arrhopalites caecus, 184.
Arthropleona, 177.
Atyphloceras, key, 89.
echis, male, 87.
Barr, W. F., Acmaeodera, 113.
Beamer, R. H., Dorycephalus, 135.
Bembicidae, 4.
Berisargus, 53.
Blackwelder, R. E., Fenyes, 17.
Blaisdell, F. E., Hopping, 1.
Bohart, G. E., Polistes, 30.
Mexico, 38.
Andrena, 39.
Lower California, 47.
Micralictoides, 119.
Bohart, R. M., Odynerus, 145.
Bombomelecta pacifica, 138.
Bombus edwardsii, 29.
vosnesenskii, 29, 139.
Bourletiella hortensis, 184.
Buprestidae, 113.
Callidium antennatum, 192.
sempervirens, 192.
Capnia decepta, 64.
elevata, 64.
jewetti, 63.
melia, 61.
nana, 66.
oregona, 63.
tumida, 65.
umpqua, 65.
Centipeds, 125.
Cerambycidae, 192.
Ceratina a. submaritima, 139.
n. rigdenae, 139.
punctigena, 139.
Cerceris *alaope*, 188.
ampla, 187.
bicornuta, 188.
clypeata, 188, 189.
convergens, 188.
deserta, 187.
dufourii, 189.
fulvipediculata, 187.
fulvipes, 187.
hebes, 187.
macrosticta, 187.
morata, 188.

* New names in bold face type, synonyms in italics.

(Cerceris—continued)
nasica, 188.
platyrhina, 188.
prominens, 188.
pudorosa, 188.
rinconis, 188.
serripes, 188.
venator, 189.
Chamberlin, R. V., Centipeds, 125.
Chelonoderus **hackeri**, 190.
Chelostoma phaceliae, 29.
Chelostomopsis rubifloris, 138.
Chlorion laeviventris, 4.
Cicadellidae, 135.
Cicindela f. gibsoni, 132.
Cleridae, 97.
Cockerell, T. D. A., Bees, 136.
Coleoptera, 113, 132, 192.
Collembola, 177.
Cope, O. B., Psocoptera, 39.
Cosmobaris scoparia, 40.
Ctenophthalmus **formosanus**, 133.
Culex erythrothorax, 81.
pipiens, 80.
salinarius, 81.
territans, 80.
Dahl, R. G., Cicindela, 132.
Dasymutilla ursula, 89.
Dendroctonus monticolae, 97.
Dicyrtominae, 184.
Dipedia, 109.
Diptera, 23, 49, 77, 163.
Dorycephalus sinuatus, 135.
Drake, C. J., Aradidae, 190.
Drepanura californica, 182.
Dufoureidae, 28.
Duncan, C. D., Termites, 43.
Embioptera, Biology, 38, 40.
Empis **montiradicis**, 163.
Enoclerus sphegeus, 97.
Entomobrya **atrocincta**, 182.
clitellaria, 182.
cyanica, 180.
griseo-olivata, 182.
marginata, 182.
multifasciata, 180.
purpurascens, 182.
suzannae, 182.
washingtonia, 182.
Eremopasites californica, 131.
Erynnis lacustra, 8.
Essig, E. O., Economic ent., 48.
Red scale, 82.
Euaraba tergata, 6.
Eumacronychia elita, 6.
Eumenidae, 27.
Euryophthalmus c. californicus, 43.
Euxesta **anna**, 25.
brookmani, 24.
Felt, E. P., Gall insects, 22.
Fenyes, A., Entomological work, 17.
Ferris, G. F., Ectoparasites, 40.
Folsomia fimetaria, 179.
guthrei, 178.
Frison, T. H., Stoneflies, 9, 61.
Gerhardt, P., Euryophthalmus, 42.
Gerridae, 95.
Gillette, Clyde, Vanessa, 165.
Gnathopasites, 130.
Good, N. E., Atyphloceras, 87.
Gynembia tarsalis, 40.
Halictus, Yosemite species, 137.
Harriot, S. C., Otitidae, 23.
Harris, H. M., Hebrus, 124.
Laporte's Essai, 161.
Hebridae, 95, 124.
Hebroveliidae, 95.
Helophilus latifrons, 6.
Hemiptera, 83, 90, 124, 155, 160, 190.
Hesperiidae, 26, 29.
Homoptera, 135, 143.
Hoplitis a. maura, 29.
Hopping, G. W., Hopping, R., 2.
Hopping, R., Obituary, 1.
Hsiao, T. Y., Miridae, 160.
Husbands, Lygus studies, 43.
Hydrometridae, 95.
Hylaeus verticalis, 136.
Hymenoptera, 4, 27, 30, 74, 108, 115, 119, 127, 136, 139, 187.
Inocellia, biology, 40.
Isocapnia abbreviata, 71.
crinita, 69.
fumigata, 70.
fumosa, 70.
grandis, 69.
Isotoma arborea, 179.
cinerea, 179.
gelida, 179.
olivacea, 179.
sensibilis, 179.
viridis, 179.
v. catena, 179.
v. delta, 179.
Isotomurus palustris, 179.
James, M. T., Empis, 163.
Myxosargini, 49.
Knowlton, G. F., Aphididae, 143.
Krombein, K. V., Tiphia, 139.
Lamiman, J., Tarsonemid mite, 45.

Laporte, F. L., Essai date, 161.
La Rivers, Ira, Stictiella, 4.
Leech, H. B., Mutillidae, 89.
Lepidocyrtus curvicollis, 182.
c. cinereus, 182.
purpureus, 182.
Lepidoptera, 8, 26, 29, 165.
Leptergatis, 109.
Leptochilus, 145.
Lerodea eufala, 26.
Linsley, E. G., Aradidae, 83.
Callidium, 192.
Lassen Hymenoptera, 27.
Parasitic bees, 127.
Tiphia, 154.
Lopidea oregona, 160.
Macrovelia hornii, 90.
Macroveliidae, 91.
Mansfield, G. S., Lerodea, 26.
Martin, J. O., Hydrometridae, 46.
Masaridae, 27.
McCracken, I., Book notice, 22.
McKinstry, A. P., Amphibicorisae, 46.
Megachile *blaisdelli*, 117.
boharti, 74.
cochisiana, 116.
dentitarsus, 116.
felipiana, 118.
frigida, 116.
hilata, 117.
inimica, 118.
instita, 76.
inyoensis, 117.
legalis, 74.
morio, 118.
nigropinguis, 118.
nivalis, 115.
pruina, 118.
redlandica, 117.
relativa, 115.
s. angelica, 117.
vidua, 116.
Megaleuctra complicata, 14.
kincaidi, 15.
spectabilis, 14.
stigmata, 14.
Melanochroa dubia, 52.
Membracidae, Bohart, 38.
Mesoveliidae, 95.
Mezira pacifica, reducta, 86.
Michelbacher, A. E., Tomato mite, 45.
Michener, C. D., Ancyloscelis, 108.
Entomology 49, 43.
Lassen Hymenoptera, 27.
Pogonomyrmex californica, 38.
Tiphia, 154.
Micralictoides, key, 120.
altadenae, 123.
mojavensis, 120.
ruficaudus, 121.
Micropasites cressoni, 130.
Mimulapis v. rufiventris, 28.
Miridae, 160.
Mitchell, T. B., Megachilidae, 74, 115.
Morulina gigantea, 178.
Mosquito records, Utah, 77.
Mutillidae, 89.
Myxosargus, keys, 57; pilosus, 59.
p. guatemalae, 60.
Neanura muscorum, 178.
Nemoura decepta, 113.
producta, 11.
pseudoproducta, 11.
tuberculata, 11.
Neopasites, 127.
Nomada erythraea, 138.
Nomadopsis anthidius, 28.
Nomenclature, 42, 144.
Nothomyia, key, 53, nigra, 55.
Nymphalidae, 8.
Ochlodes yuma, 29.
Odontella ewingi, 178.
Odontopasites arizonicus, 128.
Odynerus, key, 146.
deformiceps, 153.
infuscipennis, 147.
Lassen species, 27.
martini, 149.
platycerus, 153.
russatus, 150.
russipes, 152.
tetralobus, 148.
Oligotoma nigra, 40.
Onychiurus armatus, 178.
cocklei, 178.
fimetarius, 178.
Orchesella cincta, 183.
Oreopasites v. diabloensis, 28.
v. melantha, 28.
Osmia, Yosemite records, 138.
Ostomatidae, 97.
Otitidae, 23.
Otostigmus cooperi, 126.
Pachymeria, key, 163.
Pacific Coast Ent. Society, 31.
Painted Lady migrations, 165.
Panurginus, 138.
Pearce, spiders with Neotoma, 42.
Pediculoides ventricosus, 102.
Phycoptes destructor, 45.
Phyllophaga errans, 154.
Pleocoptera, 9, 61.
Pleocoma, Tilden, 39.

Poduridae, 177.
Pogonomyrmex californica, 38.
Polistes, Biology, 30.
Polyctenidae, 41.
Potts, R. H. L., Mexico, 46.
Proisotoma aquae, 179.
immersa, 179.
rainieri, 179.
Prosopochrysa vitripennis, 50.
Pselliodes cavincola, 126.
harveyi, 125.
nigrovittata, 125.
Pseudachorutini, 178.
Pseudomasaris, Lassen species, 27.
Pseudosinella decemoculata, 183.
octopunctata, 182.
sexoculata, 183.
violenta, 183.
Psithyrus crawfordi, 29, 139.
Psocoptera, morphology, 39.
Psyllidae, Galls, 38.
Ptenothrix maculosa, 184.
olympia, 184.
vittata, 184.
Pyrausta nubilialis from China, 39.
Pyrrhocoridae, 42.
Red Scale, 82.
Rees, D. M., Mosquito records, 77.
Reeves, Wm., Encephalitis survey, 42.
Rhaphididae, 40.
Rhaphiocerina hakiensis, 51.
Ross, E. S., Embioptera, 40.
Sapyga, Lassen species, 28.
Sarcophaga tuberosa, 6.
Scolytidae, 97.
Scott, D. B., Collembola, 177.
Scullen, H. A., Cerceris, 187.
Sinella binoculata, 180.
curviseta, 180.
hofti, 180.
sexoculata, 180.
Siphonaptera, 41, 87, 133.
Sira buski, 182.
domestica, 182.
Sminthurides sexpinnatus, 183.
Sminthurinus aureus, 184.
elegans, 184.
niger, 184.
quadrimaculatus, 184.
remotus, 184.
Sminthurus fuscus, 184.
Smith, Ray, alfalfa butterfly, 46.
Sphecidae, 187.
Sphecodes, 136.
Stelis rubi, 28.
Stenodynerus, 145.
Stewart, M. A., Flea phylogeny, 41.
Stictiella pulla, 4.
Stoneflies, 9, 61.
Stratiomyidae, 49.
Strepsiptera, 30.
Struble, G. R., Beetle predators, 97.
Sugden, J. W., Vanessa, 165.
Svihla, R. D., Ctenophthalmus, 133.
Symphypleona, 183.
Taeniopteryx contorta, 10.
kincaidi, 9.
raynoria, 9.
Tanner, V. M., 42.
Temnochila virescens, biology, 97.
Termitaphididae, synopsis, 158.
Termitaradus, key, 158.
insularis, 159.
Thanasinus lecontei, 98.
Thrips and Ceratinid bees, 38.
Tilden, J. W., Erynnis, 8; Lerodea, 26; Ochlodes, 29; Pleocoma, 39.
Ting, Peter, Cosmobaris, 40.
Tiphia shastensis, 139, 154.
Tomocerus bidentatus, 183.
flavescens, 183.
f. americanus, 183.
f. arcticus, 183.
vulgaris, 183.
Townsendiella, 130.
Trichopasites insoletus, 127.
Trichopoda pennipes, 43.
Tritoxa, key, ra, 23.
Tullbergia collis, 178.
iowensis, 178.
Udamocercia, 15.
Usinger, R. L., Aradidae, 83.
Ectoparasitic Hemiptera, 41.
Inocellia, 40; Psocids, 45.
Termitaphididae, 155.
Van Dyke, E. C., Collecting, 43.
Distribution, 47.
Obituary, R. Hopping, 1.
Vanessa cardui, 26, 165; caryae, 26.
Veliidae, 95.
Vespidae, 30.
Wind, R. G., Collecting, 42.
Woodbury, A. M., Vanessa, 165.
Xenos peckii, 30.
Xenylla *helena*, 178; welchi, 177.
Xeromegachile, 74.
Xeropasites rufiventris, 130.
Xylocopa orpifex, 139.
Zootermopsis, 43.